The American School and University

A YEARBOOK DEVOTED TO THE DESIGN, CONSTRUCTION, EQUIPMENT, UTILIZATION, AND MAINTENANCE OF EDUCATIONAL BUILDINGS AND GROUNDS

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PLANNING FOR PLANT CONSTRUCTION

America shortly will begin the transition from war to peace. After the long interval during which almost our entire production has been devoted to war, attention and emphasis will be directed once again at constructing plant, equipment, and materials for a peacetime economy. A tremendous backlog of school and college plant needs has been created. There is also the task of adapting to new construction all that we have learned in making things for war.

Studies and plans are under way. Many school and college administrators and architects and engineers are giving intensive consideration to the problems on their doorsteps. In this section, the AMERICAN SCHOOL AND UNIVERSITY shares the thinking of some of them with its readers.

PLANNING THE POSTWAR SCHOOL BUILDING PROGRAM

By N. L. ENGELHARDT

Associate Superintendent of Schools, New York City

OUR nation is committed to the continued improvement and expansion of public education. Democracy's needs can be met only through such a program. Change in educational programs, shifts in population, and deterioration in existing plants make necessary constant school building adaptations. If cessation in school building occurs, it results in a great accumulation of construction needs. This is what has happened since the Pearl Harbor event. For more than three years, relatively few school buildings have been built in the United States, and wartime priority requirements have kept school building repairs and alterations at a minimum. As a result, most communities are confronted with serious school building problems.

America's craftsmen and builders are now engaged in war work. The transition to peace pursuits must be made rapidly to avoid large-scale unemployment and its attendant economic, social, and morale dangers. Anticipatory planning is essential so that construction can begin without delay when men and materials again become available.

Wartime planning for postwar programs, therefore, becomes in a twofold way a definite duty of America's boards of education. First, further interruption of the advance of public education must be prevented, and new educational demands growing out of changing times must be met. Second, the economic stability of our communities must be maintained to the degree that new construction can make that possible.

The responsibility for postwar planning was early recognized by many boards of education but, on the other hand, was not fully realized by others. Nationwide surveys indicate wide variations in attitudes and accomplishments up to January 1, 1945, the larger cities devoting themselves more realistically to the task than the smaller communities. Only as all communities play their part, however, will the national requirements be met. The steps outlined here are intended as guides to boards of education in the advancement of postwar planning.

Survey of Educational Offerings

It is commonly recognized that peace will bring an upsurge in educational programs. Current offerings will be revised. Vocational education will be expanded. New ventures in youth education will be explored. Adult education will bring continued enlightenment and occupational rehabilitation. Pre-kindergarten needs will be stressed. Farm and camp annexes for schools will be proposed, and unprecedented emphasis will be placed upon providing adequate educational opportunities for the handicapped in all categories.

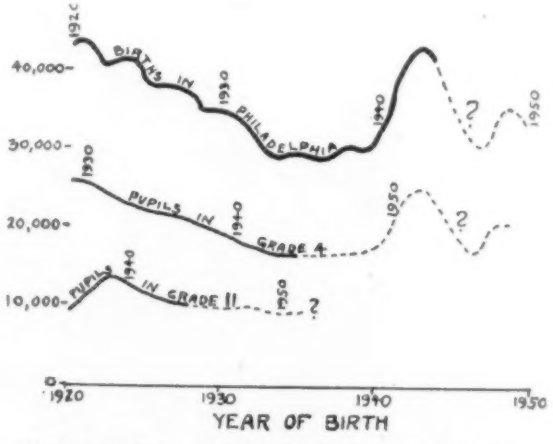
A school building program begins with the survey of local provisions for education and projects future extensions. This requires statesmanship and vision on the part of the community's educational leaders.

New Educational Emphases

America's school building planning has been influenced unduly by European traditional practices. The educational needs of our democracy must receive the future emphasis. What are some of them? The integration of school and community suggests planning a "community school." Every board of education should explore this area. Health requirements make necessary definite expansion of facilities. Where one gymnasium has been hitherto provided perhaps two or even three are needed. Guidance for each individual, and at all stages of development, indicates the desirability of better facilities. Democratic administration raises issues concerning the administrative facilities usually included in buildings. Dietary needs of children point to definite changes in cafeteria planning concepts. An amphibious people certainly should stress education for being at home in the water as on the land, while a tribious people cannot ignore the educational problems associated with the air. Postwar planning thus indicates that teacher and lay groups should be invited to consider the new emphases in educational offerings and methods. Proposed layouts of all types of educational spaces would be desirable outcomes.

Integration with City Planning

School plant planning should not be undertaken in isolation. The city-wide planning program of community centers, major streets, parks, and playgrounds



Number of Births, and Pupils Enrolled in Grades 4 and 11

Graphs, tables, charts, maps, such as these, are kept constantly up to date for all sections of the city by the Research Division of the Philadelphia (Pa.) Public Schools. The information is an important factor in long range school plant planning

and other special communal features is basic to any school building planning. Laws for assurance of safety and sanitary features result in durable construction for school buildings. Their long-term use requires complete integration into a city-wide plan in which architecture, transportation, and caution against duplication of facilities play important rôles. The size of schools to be built and those existing schools to be retained as part of the ultimate plant are decided partially through this integrating process.

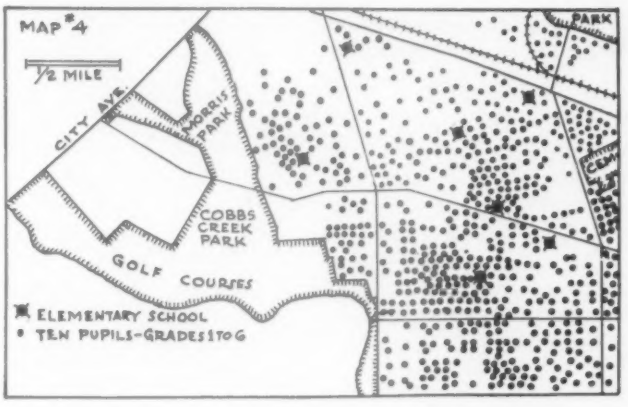
Slum Clearance and New Housing Developments

American cities have proceeded so slowly with housing replacements that slum conditions exist in all of them. The motor car has made it easy to move away from slums but the future city cannot thrive with slum centers and attractive suburbs on the periphery. Modern school buildings with sufficiently large recreational and community facilities will help much in slum riddance. New school construction

should be used as a means to rehabilitate depleted areas, but the planning should be a part of a coördinated whole.

Avoidance of Duplication of Facilities

With increasing acceptance of the social welfare of all citizens as a community obligation and with the renewed emphasis upon leisure-time opportunities for children, youth, and adults alike, the schools as well as other agencies of government are expanding their services. Park departments, health departments, and child-caring organizations serve the same clientele as the schools. There may be no necessity to draw hard and fast lines of authority or responsibility. The aim of the community should be to render the service with the best results at the lowest cost. Duplication of service and facilities must be avoided. Otherwise the cost becomes extravagant. If a health center is to be included in a school building, if a school library can be planned to serve the dual needs of school and



Where the elementary school children live

community, and if a school playground can be planned and operated for out-of-school-time use, the school investment will bring greater returns and may obviate the necessity for expensive provisions elsewhere in the area.

Comprehensive School Building Survey

No single school building should be planned except as part of a complete school building survey of the community. Such a study will include the following:

(a) Full study of adult and school population with future projections.
(b) Examination of prevailing school organization and proposals for advancement.
(c) Analysis of existing plants and decisions covering their future use.
(d) Proposals for renovation and modernization of buildings to be retained.
(e) Comprehensive plan of all new buildings that can now be anticipated for future use.
(f) Integration of school plan with programs as far as they have been proposed by a planning commission or other city departments.
(g) Preparation of maps, charts, and other data for public interpretation and clarification.
(h) Recommendations of buildings to be built at various intervals in a long-time program.
(i) Decisions on immediate planning.

Contractual Relations

The planning and construction of a school are accomplished through many contractual agreements. An architect's contract covers all services involved in planning and seeing a building through to completion. Architectural service is professional. Its detailed specification is difficult and perhaps impossible. The American Institute of Architects issues a contractual form which clarifies its ideas of contract. Many architects and boards of education have adapted forms to their own practices and experience. Comparison of many forms appears in the Thirty-third Yearbook of the National Society for the Study of Education.

Contractual relations for the construction of a building will be recommended by the architect. Boards of education usually employ legal advice, if none is existent in their organization to guide them in all contractual relationships.

Contracts define, among other matters, the amount, method and time of payment. Only accurate account-

ing and checking can protect the board fully from overpayments or losses.

Selection of Planning Services

Planning services of architects and consultants should be engaged at an early stage. They should participate in determination of site standards and in site selection. They should assist the administration and the teaching staff in decisions covering facilities to be included in projects, interpretation of community needs, and in estimates of costs. Preliminary sketches furnish a desirable take-off for discussion and should go through many stages before being frozen into approved preliminary plans. This is equally true of the small as well as the large building. Provision for state aid in the planning service has already stimulated many boards of education to early action.

School Building Manual

The continuing preparation of a school building manual is evidence of good administration in any school system. It is an essential in any city where indication of considerable school building needs has appeared. Such a manual is a compendium of educational ideas, suggestions and projected plans emanating from the experience of teachers, supervisors and

LIBRARY

SCHOOL / UNIT	ELEMENTARY			JUNIOR HIGH			VOCATIONAL			Location Floor				
	Size Sq.ft	Pupil Accom	Dwg.& Equip List	Size Sq.ft	Pupil Accom	Dwg.& Equip List	Size Sq.ft	Pupil Accom	Dwg.& Equip List	B	1	2	3	
1. Nature Study	966	36	511								X	x		
2. Library Reading Rm.	966	54	512	1600	80	522	2400	120	532		X	x		
3. Stack Room							644		533		X	x		
4. Librarian's Office							161		534		X	x		
5. Work Room				322		525	322		535		X	x		
6. Brief Case & Book Storage				100		526	161		536		X	x		

ORIENTATION: East or west exposure desirable.

GENERAL: Centrally located for school activity.
Accessible to outside for community use.
Close proximity to English and Social Science Rooms.

REMARKS

UNIT

5 — Adjoining library for extra book storage, repairing and cataloguing.

6 — Adjoining library for brief case and student's books storage to avoid theft.
Capacity to provide brief case or student's classbook storage for all library pupils.

Table from the "Manual of School Planning" of the Board of Education of New York City. The manual includes instructions to architects, data on space relationships of school departments, and a condensed statement of the general current practice of the Board's Bureau of Construction, relating to general planning, design, construction and finishing materials

other school workers. Such a document does not leave planning to chance ideas that come to the fore when building needs become urgent. It capitalizes on educational experience, teaching practices, and faults and successes of past planning. In such a manual, gleanings from periodical literature and inspections of new school buildings are incorporated.

Professional committees of teachers, custodians, supervisors, and principals contribute greatly to the improvement of planning. Such committees relate space characteristics directly to curriculum requirements, teaching method, and administrative detail. A classroom, an auditorium, an administrative suite, or a custodial workshop, like an operating room in a hospital, is best developed out of the experience of those who work in it. A school building planned for the elimination of annoyances and the convenience of operation can be expected to bring the best educational returns.

Architect and educator work best together when they have a frame of reference, i.e., a program of requirements complete with educational specifications. The underlying philosophy under which the school is expected to be administered comes first. The administration's idea of the design should be presented. The space units should be clearly defined with due reference to all features to be included. The kinds of lighting, heating, and ventilation should be specified. The arrangement and use of corridors should be made clear. Ideas concerning materials of construction which have educational implications should be noted. Suggested layouts of spaces should be provided and the character of the equipment indicated. Past practice has been to ignore the necessity for such complete assistance to the architect. A comprehensive program of requirements, with proper references to the manual, will eliminate many unnecessary conflicts in the planning process.

Review and Approval of Preliminary Plans

All concerned with planning such an intricate structure as even a small school building may be, will rec-

1-Receiving Room

17. 1-General Supply Room

18. Shop Store Rooms (Local Interior Spaces)

19. 1-Eraser Cleaning Room

20. 2-Teachers' Rest Rooms (one each sex)

IV. Additional Space Requirements

Classrooms — Section 8

No. Req.	Type	Size Sq. Ft. Each	Pupil Accom. Each	Dwg. and List No.
1	Remedial Instruction	322	----	8014

V. General Requirements

(a) Probably no part of this building need exceed three stories in height. It is desirable to keep educational spaces out of the basement. Some parts of this building may vary in height. Variations in heights, however, are left to the architect

(b) The proposed plans shall make provision for future extension of the building with due consideration given to the most economic use of the proposed site.

(c) It will be desirable to use this building for general community purposes. The planning should be in accordance with this design ... provisions ... made for

Excerpt from "Program of Requirements for Junior High School 77, Brooklyn." The "Program of Requirements," submitted to the Board of Education by the Superintendent of Schools, includes a technical description of the site, a statement of need and underlying educational philosophy, and a detailed listing of space requirements

ognize the importance of frequent reviews and revisions of preliminary sketches. This is the constructive stage of planning. Changes made at this period are not costly, while changes in final drawings require additional compensation to the architect. The characteristics of preliminary plans are not standardized throughout the architectural profession. It should be recognized, however, that the more complete, detailed, and indicative these plans are, the more able will the client be to ascertain whether the building will meet requirements. Haste in preliminary planning is bound to result in future embarrassment, if not controversy.

Perspective Drawing of the Building

In the elementary stages of planning, the architect, for his own purposes as well as to aid his clients, presents sketches showing the general design and appearance of the building. A perspective drawing, presented with the preliminary plans, is intended to indicate the final form and character of the building. It serves well in informing citizens in general concerning the school plant investment into which their funds will go.

Small Scale Models

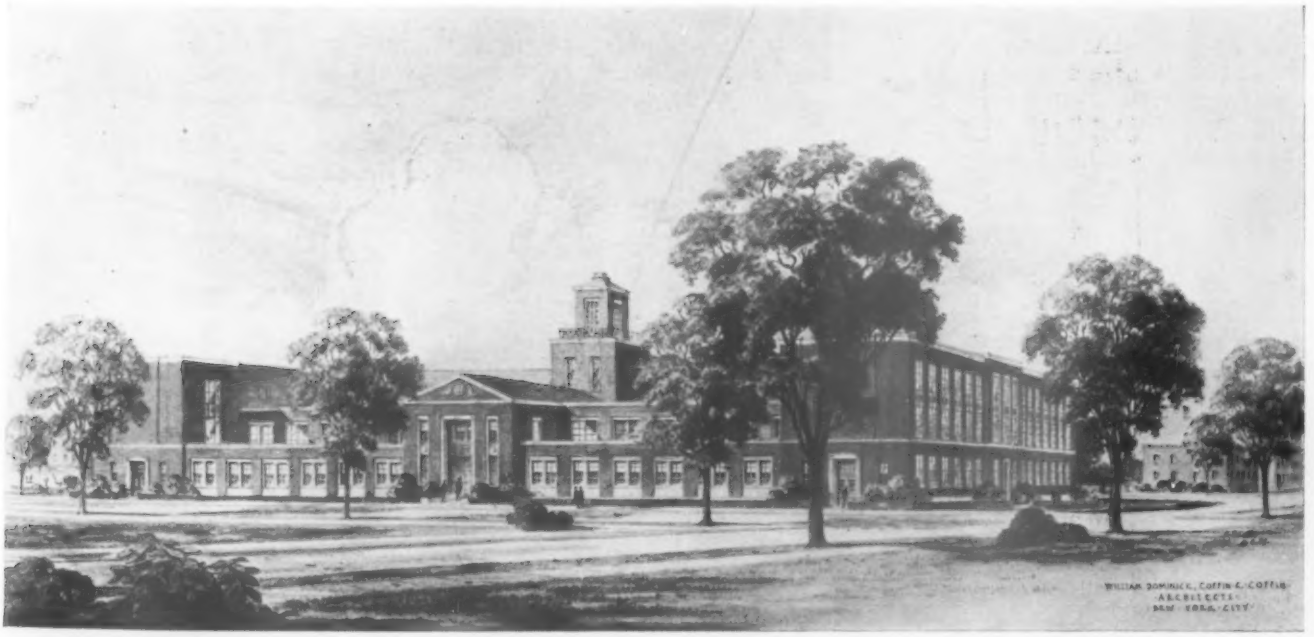
Many laymen, as well as educators, can visualize a building best if a small-scale model of the proposed structure is prepared, together with its placement on the site and the proposed development of the site. Such models clarify the results of planning to a degree not accomplished by the drawings themselves.

Preliminary Specifications

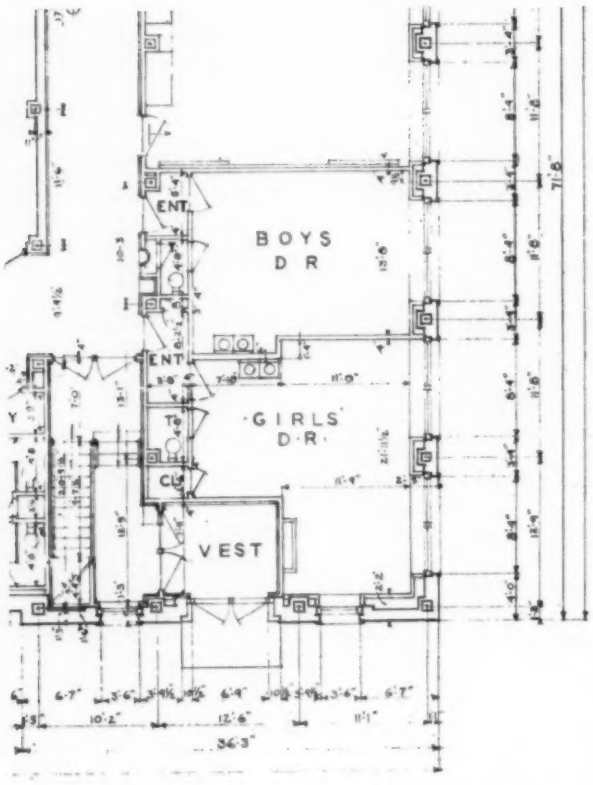
Final specifications describe building materials in detail and outline the modus operandi of construction work. Preliminary specifications give, in outline form, information helpful to the board of education in making decisions on the acceptance of preliminary plans. Many vital judgments on materials may come from discussion of specifications in this preliminary stage.

Final Working Drawings and Specifications

The work of many months of conference, discussion, and review culminates in the final working drawings and specifications. Their completeness depends upon the skill and thoroughness of the architect. Their



Perspective drawing of Public School 171 Queens, prepared for the New York Board of Education



Section of the first floor plan for Public School 171 Queens. Note, under "Office Memorandum," the provision for checking and re-checking of the working drawings

POST-WAR SCHOOL BUILDING PLANNING PROGRAM

BOARD OF EDUCATION NEW YORK CITY

MARY E. DILLON, PRESIDENT — JOHN E. WADE, SUPERINTENDENT OF SCHOOLS

PUBLIC SCHOOL NO. 171 QUEENS

BOROUGH OF QUEENS

Wm DOMINICK, COFFIN & COFFIN, ARCHITECTS

125 EAST 46TH ST. NEW YORK 17, N. Y.

TITLE OF DRAWING: FIRST FLOOR PLAN

SCALE 1/8"=1'

CONSTRUCTION PLANS | SHEET NO.

____SHEETS IN SET

CAPITAL BUDGET LINE 72-43

PROJECT NO. E50.

OFFICE MEMORANDUM

DRAWN BY_____ DATE_____ REVISED_____

TRACED " _____ " _____ "

CHECKED" _____ " _____ "

COMPARED WITH SPECIFICATIONS

FINAL SUBMISSION DATE

WILCOX & ERICKSON, STRUCTURAL ENGINEERS
11 EAST 44TH ST. NEW YORK CITY

CLYDE R. PLACE, MECHANICAL ENGINEER
GRAYBAR BUILDING NEW YORK CITY

review can be expedited through checking lists* and should be done under the direction of the superintendent of schools. At this stage, only errors and minor items of planning can be revised. Major changes in planning now become costly.

The volume of specifications is a comprehensive document, detailing the process of bidding, the forms of construction contract, the general conditions of contract, and the minute description of materials and craftsmanship. It, together with the working drawings, becomes a part of the contractual relations into which the board of education enters for construction of the building. The degree to which this document and the plans are specific and comprehensive determines the amount of extra costs that may accrue as building proceeds.

The Acceptance of the Building

On completion, after all construction has been inspected and accepted, there occurs the formal acceptance of the building by the board of education. At this stage, reliance is placed upon the architect who, as a result of his constant supervision, can give assurance that the conditions of contract have been met.

* See "Checking List of Final Workings Drawings," by N. L. Engelhardt and Associates, Bureau of Publication, Teachers College, Columbia University, New York City.

Left—Aerial view of West Campus, Duke University

Below—Lafayette School, Lexington, Kentucky

THE POSTWAR SCHOOLHOUSE

By WALTER D. COCKING

THE school and college construction which is contemplated for the period following the end of the war is of concern and interest to many people. All communities and all colleges are interested in providing adequate educational facilities. All school and college administrators are concerned with planning plants that will efficiently and adequately house the educational programs in the years to come. School architects are concerned with designing school and college plants which are in keeping with good design and which at the same time have the highest degree of utility. Manufacturers of building products and equipment have an interest in seeing that these new plants shall be constructed of the best and most modern materials and shall be equipped with the latest and most efficient equipment.

The unknown in the equation is how much construction is necessary. Several attempts have been made during the war years to discover an answer to this question. Predictions of various kinds have been based upon the information which was then available. The two predictions which have received the greatest attention are: one, a study made by Dr. Floyd W. Reeves under the auspices of the National Resources Planning Board in 1942, in which Dr. Reeves estimated that, in the ten years following the close of the war, there would be need for a postwar building program of some 9 billion dollars; and two, the prediction made by Dr. Ray L. Hamon of the U. S. Office of Education that 500 million dollars of school plant construction each year would be needed in the same period. These predictions and others which have been made have been based upon inconclusive and incomplete evidence. They were guesses arrived at from a number of known facts and conditions. In the case of both Dr. Reeves' and Dr. Hamon's studies, the conclusions were based on justifiable need and not primarily on the amount of school construction which might actually be built.

In an attempt to get a more accurate picture of probable construction, certain studies were carried on during 1944 and 1945. It is the purpose of this article to present the findings from these studies and on the basis of the results to project the amount and kind

of school and college building which will be constructed in the early years of the postwar period.

Elementary and Secondary Schools

The American Association of School Administrators in the fall of 1944 sent an inquiry blank to all members of that association. Replies were received from approximately 1,000 different school systems. The inquiry sought information on the following matters:

1. Has a survey of school building needs in your district for the postwar period been made?
2. How many new buildings will be needed?
   a. Elementary
   b. Junior high
   c. Senior high
   d. Technical
   e. Other
3. For how many new buildings have necessary sites been selected and purchased?
4. What is the total number of pupils to be accommodated in all new buildings?
5. For how many new buildings has an architect been employed?
6. For how many new buildings have preliminary drawings been prepared?
7. For how many new buildings have final blueprints and specifications been approved by the board of education?
8. For how many new buildings have contracts for construction been let?
9. How many additions to present buildings will be needed?
10. How many buildings will require major alterations?
11. What is the estimated cost of the entire building program?
12. Has a method of financing the building program been adopted?
13. What per cent of the total cost should your school district receive from the federal government?
14. What per cent of the total cost should your school district receive from the state?

Survey of Building Needs

Table 1 reveals the number of surveys of school building needs which were reported by the respondents. In addition to the replies tabulated here, a number of school systems stated that building surveys were either in process or contemplated. On the whole, the replies are encouraging. Probably never before in the history of school administration have so many school systems studied their building needs so scientifically as at the present time. The school administrators and their communities seem to understand and appreciate the importance of basing future building programs on a scientific study of all possible facts. On the other hand, one must conclude from a study of the replies that many school systems have not yet made such studies. This means that a plant building program either will be delayed or else will be based upon insufficient evidence and hence will not be in accord with the facts of the situation. It is encouraging, however, to find that a large percentage of school systems have already made the studies which are basic to any expansion program.

Kinds of New Plant Construction

An effort was made to discover the kinds or types of school plant construction contemplated. Table 2 throws light upon this problem. Replies are interesting. From the more than 800 school systems which furnished data on this question, it was found that 1,200 new elementary school buildings were contemplated, 294 junior high schools, 316 senior high schools, 129 vocational buildings, and 303 other types of buildings. Also 1,676 new additions to present structures are planned, and 928 present buildings will require major alterations. A total of 4,846 structures are contemplated by these school systems. Replies from this cross-section of school systems over the country certainly furnish evidence that there is a substantial need for a considerable number of new school buildings to house the elementary and secondary school programs of the nation. When replies from all the school systems of the country are at hand, the total number of new structures needed and contemplated will provide the largest amount of school construction ever planned at one period of time.

Status of Proposed Construction

An attempt was made to discover the stage or stages which had been reached in the contemplated school building program. Table 3 provides some interesting information with which to answer this question. Replies from more than 800 school systems show that 1,316 building sites have already been definitely secured on which to build the new structures; architects for 1,111 school buildings have been employed; preliminary drawings have been made for 815 buildings; final specifications have been approved by

TABLE 1
SURVEY OF BUILDING NEEDS MADE

Towns	Number of Replies	Yes	No	No Answer
5,000 and less	312	248	34	30
5,000 to 25,000	328	257	37	34
25,000 to 50,000	85	75	3	7
50,000 to 100,000	38	32	1	5
Over 100,000	43	37	3	3
Totals	806	649	78	79

TABLE 2
PROPOSED NEW PLANT CONSTRUCTION

Towns	Elementary	Junior High School	Senior High School	Vocational School	Other	Additions	Major Alterations	Total
5,000 and less	352	52	101	44	103	334	251	1,237
5,000 to 25,000	421	134	134	43	88	593	341	1,754
25,000 to 50,000	121	28	25	12	33	305	118	642
50,000 to 100,000	86	39	14	14	19	133	79	384
Over 100,000	220	41	42	16	60	311	139	829
Totals	1,200	294	316	129	303	1,676	928	4,846

boards of education for 263 buildings; actual contracts for construction have been let for 22 buildings; complete arrangements for financing the building program have been made by 195 school systems. These facts are further evidence that the school boards and school administrators of the nation are proceeding rapidly and intelligently with their postwar building program. They furthermore disclose that they are putting first things first, and upon the basis of the facts in hand are proceeding with the various stages of the plant program in an efficient manner. It is encouraging to know the type and character of progress being made.

TABLE 3
STATUS OF PROPOSED CONSTRUCTION

Towns	Building Sites Secured	Architect Employed	Preliminary Drawings	Final Specifications	Contracts Let	Financing Arranged
5,000 and less	399	303	268	127	3	82
5,000 to 25,000	482	414	319	185	16	69
25,000 to 50,000	114	74	72	7	0	27
50,000 to 100,000	102	52	53	19	3	10
Over 100,000	219	268	103	25	0	7
Totals	1,316	1,111	815	263	22	195

Estimated Cost of New Construction

The school systems were asked to report on the estimated cost of the new construction which they are contemplating and an impressive body of facts was gathered. Usable and definite replies to this question were received from 723 school systems. Table 4 presents these facts. An analysis of this table discloses that the total cost of the construction planned for is not the most important consideration. Much more important is the average (median) expenditure contemplated for new construction by the school systems grouped into five classes according to size of communities. This analysis shows that the average cost of new construction for school systems in communities of 5,000 and less population will be $150,000 per system; in school systems in communities of 5,000-25,000 population new construction will amount to $300,000 per system; in school systems in communities of 25,000-50,000 population new construction will average $750,000 per system; in school systems in communities of 50,000-100,000 population new construction will average $1,500,000 per system; and in communities having a population of more than 100,000 new construction will amount to $4,200,000 per system.

Based upon these averages, an attempt was made to project the probable cost of new construction to all of the communities falling within these population groups in the country. According to the 1940 census there are 4,632 communities with a population of 5,000 and less. Thus on the basis of the average cost per community of $150,000 for new construction, it can reasonably be expected that communities of this size will expend approximately $700,000,000 for new school plants. There are 1,630 communities with a population of 5,000-25,000. Based upon an average expenditure of $300,000 per community, these 1,630 communities will expend approximately $500,000,000 for new school plant construction. Again there are 213 communities with a 25,000-50,000 population. Using the average of $750,000 for new construction per community the estimated school plant construction in these communities will amount to approximately $160,000,000. One hundred and seven communities have a population of 50,000-100,000. Replies received from communities in this group show an estimated average expenditure for new construction of $1,500,000 or a total for the 107 communities of approximately $160,000,000. There are 92 communities with a population of over 100,000. Using an average of $4,200,000 for new construction, the total contemplated school plant construction in these communities will amount to $386,000,000. In other words, the total estimated cost of new school buildings in the groups of communities listed will amount to $1,900,000,000. Indeed a sizable amount.

It is to be understood that these figures do not include rural and consolidated schools. It is in this area that some of the greatest school plant construction needs exist. It is also in this area that the great-

TABLE 4
ESTIMATED COST OF PUBLIC SCHOOL CONSTRUCTION

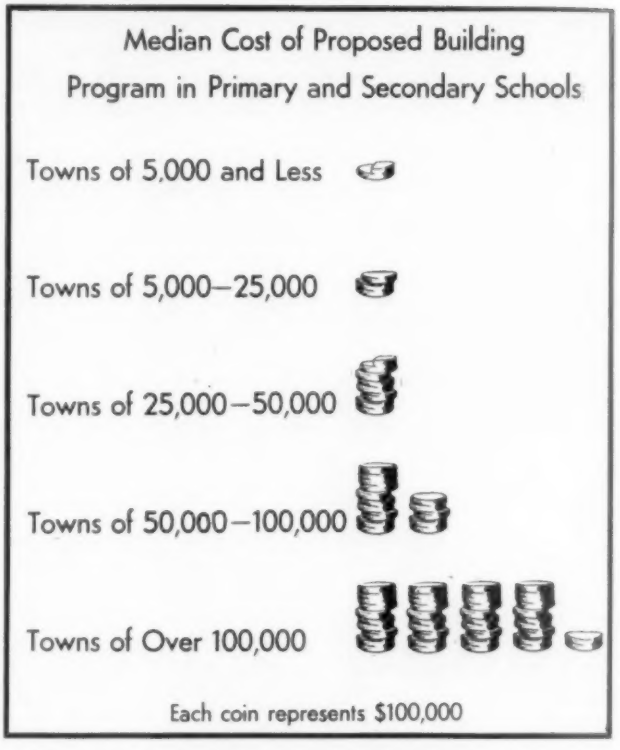
Towns	Number of Replies	Total Estimated Cost	Median Cost	Number of Towns	Total Estimated Cost (Projected)
5,000 and less	283	$ 91,339,000	$ 150,000	4,632	$ 700,000,000
5,000 to 25,000	290	137,192,000	300,000	1,630	500,000,000
25,000 to 50,000	78	73,046,000	750,000	213	160,000,000
50,000 to 100,000	34	54,429,000	1,500,000	107	160,000,000
Over 100,000	38	320,344,000	4,200,000	92	380,000,000
Totals	723	$676,350,000		6,674	$1,900,000,000

est changes will probably take place. Many states have administrative reorganizations of school districts under way. When these reorganizations are completed, many small inefficient one- and two-room schools will be eliminated and in their places will be built permanent modern consolidated school buildings. At the present time, figures are not available which would indicate the amount of this type of construction, but, from the facts which are known, it is conservatively estimated that the amount of construction of this character will total from $500,000,000 to $750,000,000.

This is the program of school plant construction which is being planned for the years following the war. It is clear that it is more than a mere wish or dream. The work which has already been done and which is continuing clearly shows that there is every reason to believe that many buildings will be built and equipped, and that a sizable amount of construction will be under way as soon as wartime conditions will permit.

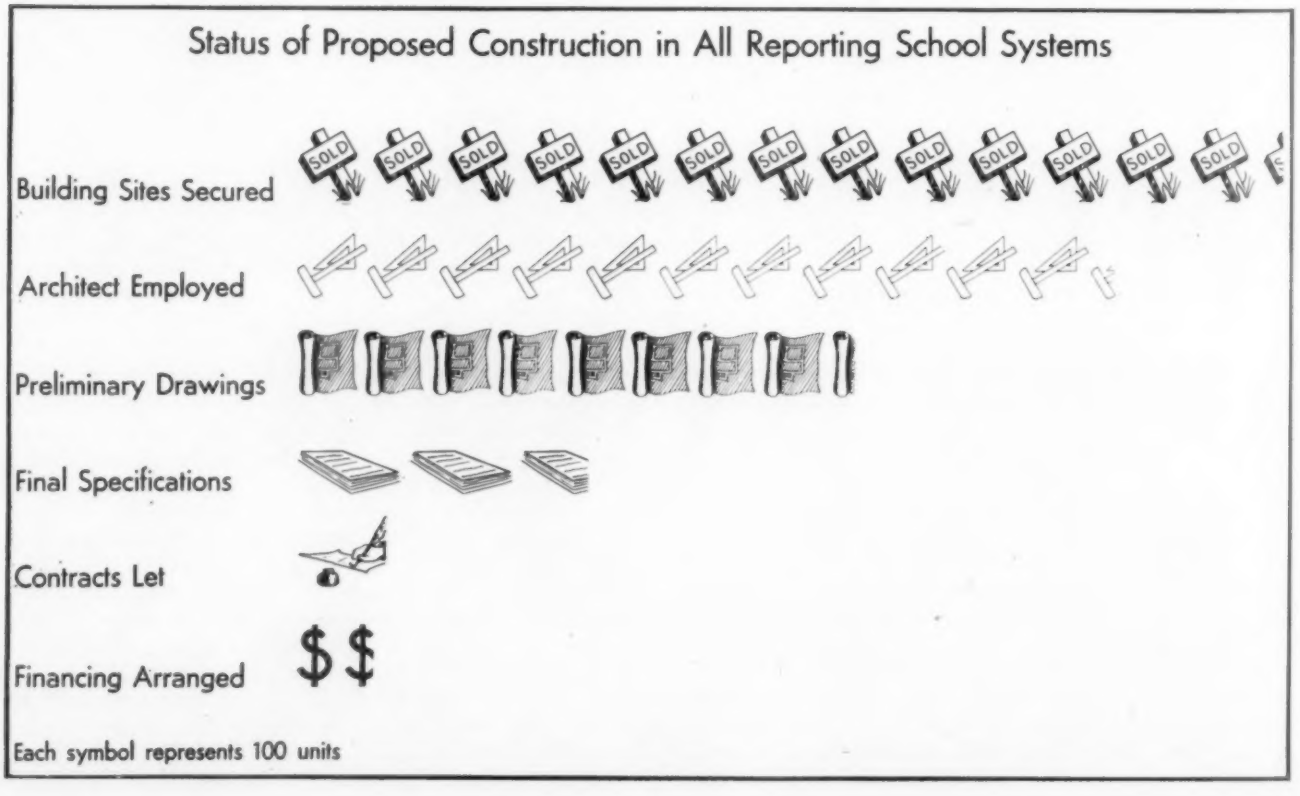
Colleges and Universities

Recently an attempt was made to secure from the colleges and universities of the country information on their building plans and programs for the postwar period. It was the intent of the inquiry to discover the stage of building planning and also to determine the probable amount and cost of such building. To date, replies have been received from more than 260 institutions and others continue to come in. Replies have been received from institutions in 45 of the 48 states and from four types of institutions: municipal colleges, teachers colleges, state universities and other


Median Cost of Proposed Building
Program in Primary and Secondary Schools
Towns of 5,000 and Less
Towns of 5,000–25,000
Towns of 25,000–50,000
Towns of 50,000–100,000
Towns of Over 100,000
Each coin represents $100,000

Above—Not represented in these estimates are the rural districts, where the greatest school plant needs exist. It is anticipated that reorganization of rural units will be accelerated after the war, with modern consolidated plants taking the place of one- and two-room schoolhouses.

Below—"a large percentage of school systems have already made the studies which are basic to any expansion program"



state colleges, and private colleges. Ten questions were asked on the inquiry blank as follows:

1. Has a survey of building needs at your institution for the postwar period been made?
2. a. How many new buildings will be needed?
   b. How many additions to present buildings?
   c. How many buildings will require major alteration?
3. For how many buildings has the type of program to be housed been determined?
4. For how many buildings has the number of students to be housed in each building been determined?
5. For how many buildings has an architect been employed?
6. For how many buildings have preliminary drawings been prepared?
7. For how many buildings have final blueprints and specifications been approved by your governing board?
8. For how many buildings have contracts for construction been let?
9. What is the estimated cost of the building program?
10. Has a method of financing the building program been adopted?

Replies from approximately 50 of the institutions were general in character and indicated that their building program had not yet reached the stage at which specific information was available. It seems accurate to conclude that there are a considerable number of colleges and universities which have not as yet given detailed attention to their postwar building needs or at least have not taken definite action. Of course, this means that for those institutions the ultimate building program will be delayed for a considerable period of time after wartime restrictions have been removed. Usable replies were received from 9 municipal colleges, 56 teachers colleges, 56 other state institutions, and 138 private colleges, or a total of 259 institutions. These replies represented all sections of the country and all types of institutions. It is important to note that replies from these institutions show that practically all of the institutions listed have already made surveys of their postwar building needs. This is encouraging. Again it is an indication that scientific planning methods are being followed by the colleges in forecasting their future building programs. Two hundred institutions replying have made complete and comprehensive surveys of their present plant situation and probable future needs.

Number of Buildings

Institutions report plans for 1,008 new buildings as follows: municipal colleges, 52 buildings; teachers colleges, 182 buildings; other state institutions, 389 buildings; and private colleges, 385 buildings. These same institutions also report the need for additions to 262 of their present buildings, and they also state that major alterations are required for 277 other buildings. Thus, more than 200 institutions reporting show a total postwar building program involving 1,547 buildings.

Status of Proposed Construction

It is interesting to note the degree to which various steps in the planning of the building programs had progressed at the time the report was made. Briefly summarized, the situation as of the late fall in 1944 was as follows: 1) surveys which have been made show a need for 1,547 new buildings in 216 institutions; 2) the type of educational program to be housed in these structures had been determined for 1,195 of them; 3) the actual size of the building planned had been determined for 830 buildings; 4) architects have been employed to design 601 of these buildings; 5) preliminary drawings have been prepared for 414 structures; 6) final blueprints and specifications have been approved by the governing boards for 85 buildings; 7) actual contracts have been let for the construction of 18 buildings.

The replies indicate, therefore, that steady progress is being made in the development of the postwar building program. It is also important to point out that most of the institutions are proceeding in an orderly manner. The replies indicate that surveys of building needs are well in hand. It is encouraging to note the number of institutions which have determined the type of buildings to be built, the type of program to be housed in each, the number of students to be accommodated, the employment of architects, and the preparation of preliminary and final drawings and specifications. Of course, at this time it is not to be expected that contracts for much, if any, construction would have been let. It is important, however, that planning up to the stage of the actual letting of contracts should be completed at as early a date as possible.

Cost of College and University Building

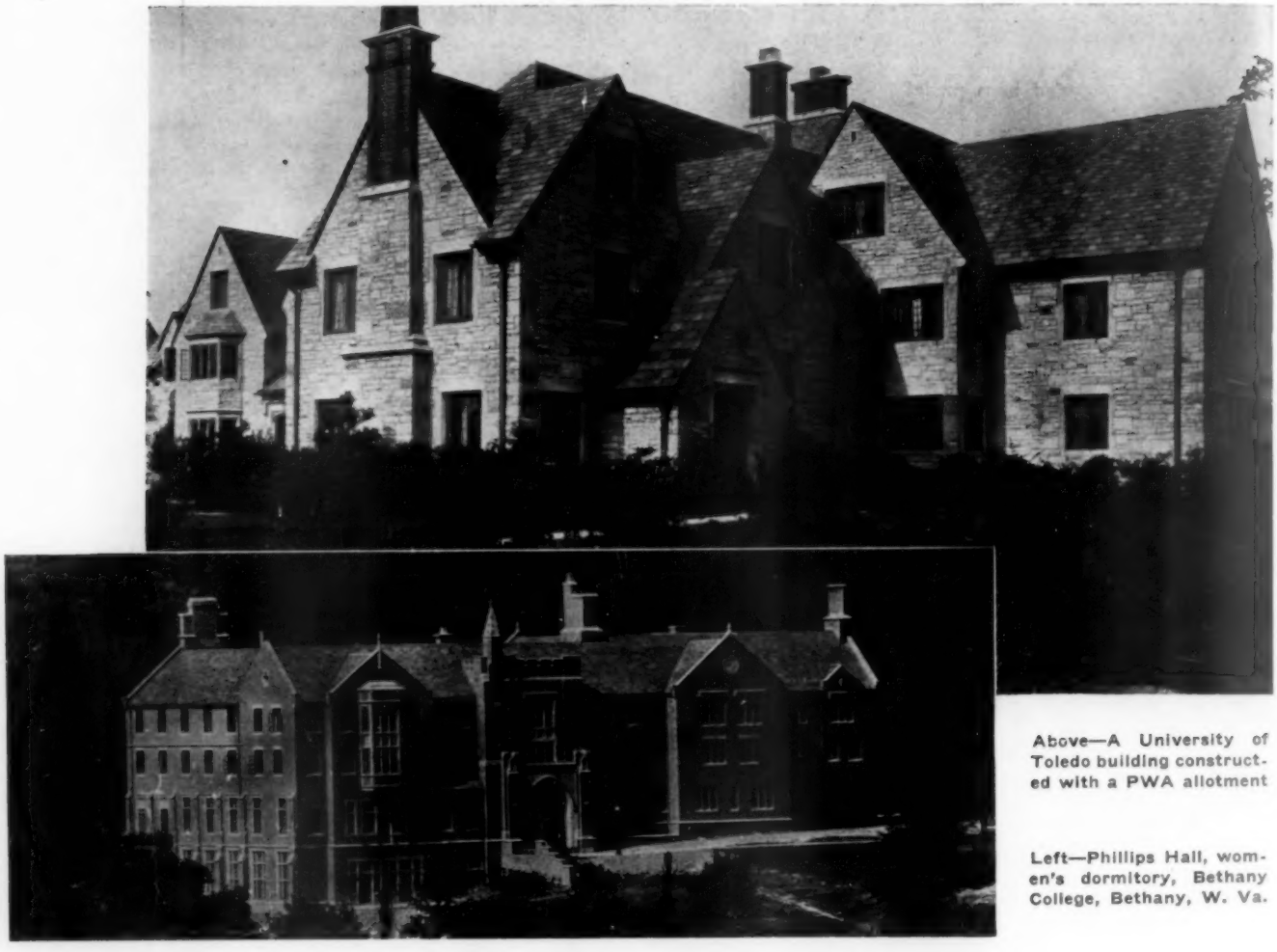
It is interesting and important to analyze the cost of the building program as estimated by college and university officials. The municipal colleges report a total estimated expenditure of $36,161,200 or an average of $4,107,910 per institution; the teachers colleges report a total estimated expenditure for buildings of $53,829,800 or an average of $1,251,855 per institution; state universities and other state colleges report a total estimated expenditure for buildings of $100,753,000 or an average per institution of $2,289,840; private colleges report a total estimated expenditure for buildings of $66,937,000 or an average per institution of $572,111. The total estimated expenditure for postwar buildings for the institutions reporting is $257,681,000 or an average per institution of approximately $994,907.

TABLE 5

ESTIMATED COST OF COLLEGE CONSTRUCTION

Types of Institutions	Number of Replies	Total Estimated Cost	Average Cost
Private Colleges	138	$ 66,937,000	$ 572,111
Municipal Colleges	9	36,161,200	4,107,910
State Teachers Colleges	56	53,829,800	1,251,855
Other State Institutions	56	100,753,000	2,289,840
Totals	259	$257,681,000	$ 994,907
College Building Program (1,690 Institutions) Total Estimated Cost (Projected) . . . $1,690,000,000			

The United States Office of Education figures show that there are 1,090 private colleges, and 600 public colleges or a total of 1,690 institutions. While the actual total number of colleges and universities in the United States is somewhat greater than this figure,



Above—A University of Toledo building constructed with a PWA allotment

Left—Phillips Hall, women's dormitory, Bethany College, Bethany, W. Va.

yet it is the best available. The replies to this survey are sufficiently well distributed both geographically and in terms of types of institutions to warrant projecting them to the total number of colleges and universities in the nation. From the information in hand, therefore, it would appear that the colleges and universities of the country are planning postwar building programs which total approximately $1,690,000,000. If this building program should be spread evenly over a period of ten years then there would be reason to anticipate a program of new building construction for the colleges and universities of the country of $169,000,000 a year for the ten-year period following the resumption of the peacetime economy. In any case, the construction program in the colleges and universities will be the largest in the history of the country. The figures also demonstrate that the colleges of America plan to do their full part in providing necessary public works for the postwar period.

Financing the New Building Program

An attempt was also made to determine if definite plans had been made to pay for the cost of the proposed construction. In other words, is the proposed program reported above merely wishful thinking on the part of college officials or have necessary steps already been taken for financing such a program. The replies to the inquiry indicate that a majority of the institutions have already faced this problem. In many institutions the money is already in hand, or definite plans have been made to secure it. In the case of the tax-supported institutions most of the actual financing of the new structures must await legislative appropriations.

Conclusion

When the results of the inquiry for all kinds and classes of schools, elementary, secondary, college, and university, are grouped together, it is plainly evident 1) that a very large amount of new building is needed to care properly for the educational program in the post war years; 2) that very definite studies and plans are under way preparatory to actual construction; 3) that the total actual building program will involve an expenditure of more than $4,250,000,000. An analysis of the replies indicates that the statement of building needs and probable expenditures tend to fall on the conservative side. Even so, the building program being planned in the educational institutions throughout the country is the greatest in our history and will require careful planning and administration if it is to be achieved. To build more than $4,000,000,000 of new construction in a short period of time is a tremendous job even in the United States of America.

THE FUNCTIONS AND WORK OF THE NATIONAL COUNCIL ON SCHOOLHOUSE CONSTRUCTION

By JAMES L. GRAHAM

Secretary-Treasurer, National Council on Schoolhouse Construction
Supervisor, Plants and Transportation, State Department of Education, Tallahassee, Fla.

THE National Council on Schoolhouse Construction is a voluntary association of persons with a professional interest in bettering the physical conditions of school buildings. Through its Committee on Standards, the council has prepared a number of recommendations in regard to various conditions which affect the health and comfort of the pupils. It presents them as a contribution to what it proposes will cover eventually the various factors that enter into a proper understanding of the physical needs of a school and the means whereby they may be achieved.

The council's recommendations, at the present time, cover the following factors pertinent to school plant planning:

School Grounds
Playgrounds and Athletic Fields
General Construction
Corridors
Stairways
Exits
Administration Rooms
Classrooms
Kindergartens
Libraries
Science Laboratories
Commercial Departments
Rooms for Public Speaking and Speech
Art Rooms
Music Rooms
Industrial Arts Shops
Mechanical Drawing Rooms
Home Economics Laboratories
Physical Education Rooms
Swimming Pools
Auditoriums
Cafeterias
Medical Inspection and Clinical Rooms
Special Classrooms
Rest Rooms
Sanitary Facilities
Service Systems
Service Rooms
Study Halls
Visual Education
Fenestration
Artificial Illumination

Early History

Three men met in the lobby of an Atlantic City hotel on the afternoon of March 2, 1921. Their meeting was not accidental but deliberately planned. They had corresponded with one another, as well as with other men who might be interested in the same problems as they were, in regard to an informal meeting for the purpose of talking over school building problems. The three men were: Charles McDermott, now deceased, then inspector of school buildings for the State of New Jersey; Frank H. Wood, then chief of the School Buildings and Grounds Division of the State Education Department of New York, now educational consultant on school building construction; and Samuel A. Challman.

They conferred and conversed for several hours, and after some discussion, it was agreed to attempt to effect an organization of persons dealing with school building problems in an official capacity. For the purpose of having the object of this organization clearly understood, three main purposes were agreed upon. These were:

1. To promote the establishment of reasonable standards for school buildings and equipment with due regard for economy of expenditure, dignity of design, utility of space, healthful conditions, and safety of human life.
2. To combat wastefulness, poor planning, questionable equipment, and other undesirable features whereby the best interests of children are not served; and
3. To disseminate such information with regard to school buildings as may be of value to the public and to school officials.

Charter Membership

Before completing the organization it was agreed that all state officials who now pass upon plans and specifications should be invited to become charter members and that all such officials should be accorded the privilege of nominating other persons for charter membership. Such persons would then become members upon being duly elected by those already constituting the organization.

After due deliberation and after rejecting many suggested names for this new organization the name, "The National Council on Schoolhouse Construction," was unanimously adopted.

Program at First Meeting

During the year elapsing after the informal meeting, the following persons were added to the charter membership: William C. Bruce, editor, *American School Board Journal;* C. B. J. Snyder, architect, Board of Education, New York City; John J. Donovan, architect and author of *School Architecture,* Oak-

land, California; and HuBert C. Eicher, director, Bureau of School Buildings, Department of Public Instruction, State of Pennsylvania. These men participated in the first organized meeting.

The first meeting of this council was held at the Statler Hotel, Buffalo, N. Y., on April 18 and 19, 1922. The council organized by electing Samuel A. Challman, president, and Wm. C. Bruce, secretary. As the membership consisted of but seven, the program was mostly informal and the discussions naturally centered around the problems with which the various members had been confronted. Mr. C. B. J. Snyder presented a comprehensive program based on fundamental principles affecting school building standards, and urged each member to devote himself to the study of some phase of this program and report on the same at the next meeting. The program included the following topics: (1) Classification of Buildings; (2) Limitations as to Size, Arrangement, and Height; (3) Exit Facilities and Fire Prevention; (4) Problems of Construction; (5) Heating and Ventilation; (6) Sanitation; (7) Natural and Artificial Illumination; (8) Electrical Equipment; (9) Other Equipment and School Furniture.

Council Learns Formula for School Size

At the next meeting which was held in a committee room of the Cleveland Municipal Auditorium on February 25 and 26, 1923, one whole session was devoted to a discussion of the classification of school buildings. The A.I.A. classification was made the basis for the discussion and, while not adopted, was given much favorable comment. The second session was devoted to a discussion of methods for measuring the capacity of school buildings and determining their size. Mr. Clarence D. Kingsley, of Boston, presented a formula he had been using which afterwards published in the Report of the Committee on Schoolhouse Planning of the National Education Association. Mr. Kingsley also brought up the question of space for gymnasiums and for lockers and showers. These subjects evoked much profitable discussion. The last subject to be considered was a discussion on heating and ventilation by HuBert C. Eicher who had selected

By-Laws of the National Council on Schoolhouse Construction

I. Name of Organization

The name of this organization is, The National Council on Schoolhouse Construction.

II. Purpose of Organization

The purposes of this organization are:

1. To promote the establishment of reasonable standards for buildings and equipment with due regard for economy of expenditure, dignity of design, utility of space, healthful conditions, and safety of human life;

2. To combat wastefulness, poor planning, questionable equipment, and other undesirable features, whereby the best interests of the children are not served;

3. To disseminate such information with regard to school buildings as may be of value to the public and to school officials.

III. Qualifications of Members

Membership in the Council shall be open to the following groups:

1. Directors of divisions of federal and state departments charged with the direction of schoolhouse planning or the approval of school plans, together with their assistants.

2. Directors of schoolhouse planning and their assistants in political subdivisions of the states.

3. Members of permanent state or municipal survey staffs whose duties are chiefly concerned with school plant programs.

4. Members of staffs of schools of education of universities and colleges who are responsible for the direction and supervision of instruction in the theory of schoolhouse planning and research problems connected therewith.

5. Other persons having interests and relationships with public school plants may be elected to membership by the unanimous vote of the members of the Council, present and voting, at any annual meeting.

6. All applications for membership shall be referred to the Executive Committee which shall investigate and report its findings with recommendations to the Council.

IV. Officers

The officers of this organization shall be a president, a vice-president, a secretary-treasurer, each of whom shall perform the usual duties of his office and serve ex-officio as a member of the Executive Committee.

There shall be also an Executive Committee of three members serving for overlapping three-year terms who shall perform such duties as may be assigned to it.

These officers shall be elected by the Council at its annual meetings.

The incoming president will appoint the standing committees and liaison officers to serve for the ensuing year.

V. Membership Fees

Membership in the Council shall not be consummated until the initial fee of $5.00 shall be paid, said fee to cover membership dues for the then current year.

VI. Annual Dues

The annual dues shall be $5.00, and shall be payable at the annual meeting.

VII. Termination of Membership

Membership shall terminate upon failure to pay dues for two consecutive years. Restoration to membership shall be conditioned upon the payment of dues for the preceding and then current years.

If a member shall fail to be in attendance at the annual meeting of the Council for three consecutive years, continuance on the membership roll shall be conditioned upon favorable action of the Executive Committee.

All present members of the Council and all who may be hereafter admitted to it shall retain membership as long as the *By-Laws* relating to dues and attendance are met.

VIII. Time and Place of Meeting

The time and place of the annual meeting shall be determined by the Executive Committee serving for the year in which the meeting is to be held.

IX. Changes

Changes in these *By-Laws* may be made at any annual meeting by a two-thirds majority of the members present.

this topic in furtherance of the program outlined at the Buffalo meeting.

This meeting brought into the membership of the council the esteemed president of the council, John J. Blair. We had as guests at this meeting: W. R. McCornack, architect, Cleveland, Ohio; Dwight H. Perkins, architect, Chicago; James O. Betelle, architect, Newark; and Clarence D. Kingsley, high school inspector for the State Department of Education, Boston. No change was made in the officers of the council.

Ventilation and Exit Code Aired

In 1924 no meeting was held, but in 1925 the council met at Harrisburg, in the Senate Caucus Room of the Pennsylvania State Capitol. At this meeting the council's genial host, C. M. Hirst; H. W. Schmidt, state supervisor of school buildings for Wisconsin; and Francis R. Scherer, assistant superintendent of school buildings of Rochester, N. Y., were welcomed into the fold. The chief concern of the meeting appears to have been the troublesome question of school ventilation. As guests and speakers, representatives of four companies manufacturing ventilating equipment, had been invited. Each explained and described the unit ventilating device in which he was particularly interested and a very interesting discussion developed among the members of the council.

Two other topics engrossed the attention of the members. One was a lecture on "European Architecture," by HuBert C. Eicher who had traveled extensively in Europe during the summer preceding the meeting. The other was a communication to the Exits Code Committee, in which the council went on record as being unalterably opposed to placing auditoriums above the second-floor level and also opposed to releasing bars shorter than three quarters of the width of the door.

Lighting, Heating and Ventilation

The fourth meeting of the council was held in St. Paul on November 18 and 19, 1926. At this meeting Dr. Fletcher B. Dresslar and S. L. Smith, both of Nashville; H. G. Perring, of Baltimore; R. E. Ledbetter, of Alabama; and Haskell Pruett, of Oklahoma, were added to the membership. The subjects discussed included "School Fenestration," "Interior Arrangement of School Buildings," "Insulation of Buildings," "Heating and Ventilation," "The Economical Use of Coal and Oil as Fuels," "The Upkeep of Buildings," and other kindred topics. One of the features of the meeting was the exhibition of a film, illustrating the dangers of slipping on sidewalks, stairways, and other surfaces, presented by Mr. H. W. Mowery, safety engineer, who was the guest of the council and an invited speaker.

At the business session the following officers were elected for the ensuing year: HuBert C. Eicher, president; Frank H. Wood, vice-president, and Wm. C. Bruce, secretary-treasurer.

Various Aspects of School Plant Discussed

In 1927 the council met at Nashville, Tenn., on October 19-21. Nine new members were admitted. These were: Raymond V. Long, state director, Division of Buildings, Richmond, Va.; J. O. Martin, supervisor of schoolhouse planning, Atlanta, Ga.; J. T. Hoel, state supervisor of schoolhouse planning, Baton Rouge, La.; O. H. Bernard, state rural school supervisor, Nashville, Tenn.; W. G. Eckels, state director of school buildings, Jackson, Miss.; J. Fred Horn, state director of school buildings, Austin, Tex.; Andrew B. Hill, chief, Division of Schoolhouse Planning, Sacramento, Calif.; A. B. Moehlman, professor of school administration, Ann Arbor, Mich.; and A. F. Dittmar, school architect, Department of Education, Montgomery, Ala.

Owing to the illness of President Eicher which prevented his attendance, Vice-President Frank H. Wood presided over the meeting. The council was accorded a warm welcome by Dr. P. L. Harned, commissioner of education of the State of Tennessee. Many courtesies were extended by Dr. Dresslar of Peabody College, and by Mr. Smith, general field agent of the Julius Rosenwald Fund. The program was interesting and instructive, dealing with the school plant in its relation to health education, to architectural and engineering requirements, to aesthetic expression, to educational needs, to financial support, and to the modern demands of society. Officers elected for the ensuing year were: Frank H. Wood, president; S. L. Smith, vice-president; and W. C. Bruce, secretary-treasurer.

Meeting Places and Presidents

Year	*Place*	*President*
1922	Buffalo	S. A. Challman
1923	Cleveland	S. A. Challman
1925	Harrisburg	S. A. Challman
1926	St. Paul	S. A. Challman
1927	Nashville	HuBert C. Eicher
1928	Raleigh	Frank H. Wood
1929	Rochester-Albany	S. L. Smith
1930	Little Rock	J. J. Blair
1931	Richmond	Francis R. Scherer
1932	Hartford	Raymond V. Long
1933	Milwaukee	H. W. Schmidt
1934	Washington	J. Fred Horn
1935	Washington	R. H. F. Halsey
1936	Austin	W. G. Eckles
1937	Columbus	T. C. Holy
1938	Frankfort	W. F. Credle
1939	New York	A. B. Moehlman
1940	Chicago	John W. Brooker
1941	Virginia Beach	John W. Lewis
1942	Cleveland	N. E. Viles
1943	Cincinnati	Thos. J. Higgins
1944		S. P. Clemons

Proceedings of the Council

The proceedings of the annual meetings of the National Council on Schoolhouse Construction, during recent years, have been printed and are available to the public through its secretary, J. L. Graham, State Department of Education, Tallahassee, Florida, at 50 cents a copy. The 1944 meeting was deferred on request of the Office of Defense Transportation; however, the "Proceedings of the Twenty-First Annual Meeting" are available. The theme of this annual meeting was "Postwar Planning." Papers were presented on postwar planning by the various members at the following levels: at the state level, at the federal level, at the city level, at the college and university level.

POSTWAR BUILDING PROGRAM

SCHOOLS IN 1945 CAPITAL BUDGET (80 PROJECTS), BOARD OF EDUCATION OF THE CITY OF NEW YORK, DIVISION OF HOUSING AND BUSINESS ADMINISTRATION

	Scope to City Planning Commission	Area Adopted by City Planning Commission	Site Selected by the Board of Education	Site Approved by the Board of Estimate	Site Owned	Prog. of Requirements App. by the Bd. of Ed.	Project To Be Designed by	Contract Executed with Private Architect	Joint Operation with Park Department	Preliminary Plans—Per Cent of Completion	Final Plans—Per Cent of Completion
BOROUGH OF THE BRONX (13 PROJECTS)											
P.S. 3, Add.*	X	−N−			0		BC	−N−	P		
P.S. 12, Add.*	X	−N−	X	X	0	X	BC	−N−		100	100
P.S. 13	X						BC	−N−			
P.S. 18	X	X	X	X		X	PA	X	P	100	50
J.H.S. 22	X	X	X	X		X	BC	−N−	P	100	100
P.S. 81, Add.	X	−N−	X	X	0	X	BC	−N−	P	100	50
P.S. 102, Add.	X	−N−	X	X	0	X	BC	−N−	P	100	100
P.S. 105, Add.	X	−N−	−N−	−N−	000	X	BC	−N−		100	100
P.S. 106, Add.	X	X	X	X	0	X	BC	−N−	P	100	100
J.H.S. 125#	X	X	X	X		X	BC	−N−	P		
Bronx P.	X	X−	X	X	0	X	BC	−N−	P	100	100
P.S. 12	X	−N−	X	X	000	X	BC	−N−	P	100	100
P.S. 16, Add.	X										

X = Item completed
N = Not required
O = Site partly owned

BC = Bureau of Construction
PA = Private architect
000 = Site completely owned

* = New project added in 1945
\# = New project added in 1944
P = Joint operation with Park Department.

Fig. 1. Excerpt from progress report. Note provision for review of plans by City Planning Commission

SCHOOL PLANT PLANNING AS PART OF OVERALL COMMUNITY PLANNING IN CITIES OVER 100,000 POPULATION

By CALVIN GRIEDER

Associate Professor of School Administration, University of Colorado, Boulder

A SURVEY of the extent and nature of joint planning of school facilities by city planning authorities and school districts in cities over 100,000 population gives rise to feelings of both optimism and pessimism. In response to inquiries sent in August 1944 to all school superintendents and many city planning commissions of the 92 cities in this population group, replies from 63 cities (69%) were received. A careful evaluation of the responses, in the form of letters, charts, survey reports, and city plan documents, indicates that no joint planning is being done in 25 cities, a close relationship exists between school systems and city planning agencies in 27, and a more or less informal or gentlemanly relationship obtains in 11.

Two Big Cities Furnish Good Examples

Joint planning may perhaps be best defined by illustrations from two of the largest cities. Los Angeles reported as follows:

With the cooperation of officials of the Los Angeles City Board of Education, a comprehensive survey has been made of the existing school plant facilities of the Los Angeles School District, of the smaller school districts in the environs, and of the parochial school system. The data collected include: the name and location of the school; type, whether elementary, junior high or senior high; the number of grades; the capacity and type of permanent buildings; the number of rooms in each building; the number of temporary classroom units; proposed future construction; enrollment in February 1940 and in February 1943; the total area of the site; and the area of the playground.

These data have been analyzed and tabulated and the sites have been mapped and will be used in the drafting of a master plan of schools. In the preparation of this plan the cooperation of the school authorities has been enlisted. *The plan will be the result of the joint efforts of school authorities and the planning department.*

Joint planning is likewise apparent in New York City. The postwar planning program launched by Mayor LaGuardia is probably the largest ever promulgated by any city in the world's history. The total value of the projects proposed is $1,270,000,000. All types of construction projects required by the various city departments are included. As far as possible, the work of all city departments is fully correlated,

and the review of all plans has rested with the City Planning Commission and other city authorities. About $118,678,000 will be needed to provide for the sites and public school buildings included in the program, or about 9.3% of the total. No other component of the program is as large as this. See Fig. 1.

Integrated Planning Checks Deterioration

In emphasizing the importance of joint planning N. L. Engelhardt, associate superintendent in charge of the Division of Housing and Business Administration of the New York school system, states:

> The task of planning schools for a city the size of New York is a very complicated one. Studies are first made of shifts of population and of the anticipated population in certain areas over the next few decades. Use of the existing plant, the question of its modernization, and the general character of the organizational unit to be erected, are factors requiring intimate study. When a new school building is planned for a city like New York, a site must be thought of in terms of its complete adequacy for play as well as for building purposes. The cost of securing an adequate site and the expense of erecting a substantial building constitute a large investment approximating a million dollars at least. Before such an investment is made, the most detailed studies are required of the areas to be served, so that assurance will be given that a new school building will continue to serve an area satisfactorily over a considerable period of time.
>
> *Such educational surveys must be integrated fully with all other aspects of city planning.* This includes housing, recreational areas, new thoroughfares, and new industrial developments. This analysis is of particular value where deterioration of areas has set in as it has in most of our cities. In New York City, special emphasis is placed upon planning in direct relationship to new housing and in cooperation with the Department of Parks, so that play areas may be utilized not only by school children but also during out-of-school hours by other members of the community.

Good examples of joint planning can also be found in Detroit, Oklahoma City, Baltimore, Des Moines, Boston, Portland (Ore.), Memphis, San Francisco and other centers. A much publicized effort is found in the Syracuse-Onondaga Post-War Planning Council, which has set up an educational committee as one of a number of subcommittees. Thus far, however, the committee has concerned itself more with the cultural aspects of a desirable educational program than with the plant aspects, which are yet to be studied. Dayton's scheme of organization for planning is shown in Fig. 2. The District Development Committee is composed of 165 members. The planning of school facilities belongs to the subcommittee on community planning, working closely with school officials.

If cities continue to decentralize, such outward movement must be guided; and if they can be prevented from decentralizing and the central areas can be restored and property values stabilized (which is preferable), sound planning is required. In neither case can a school board make intelligent plans without coordination with all other factors, as definite steps

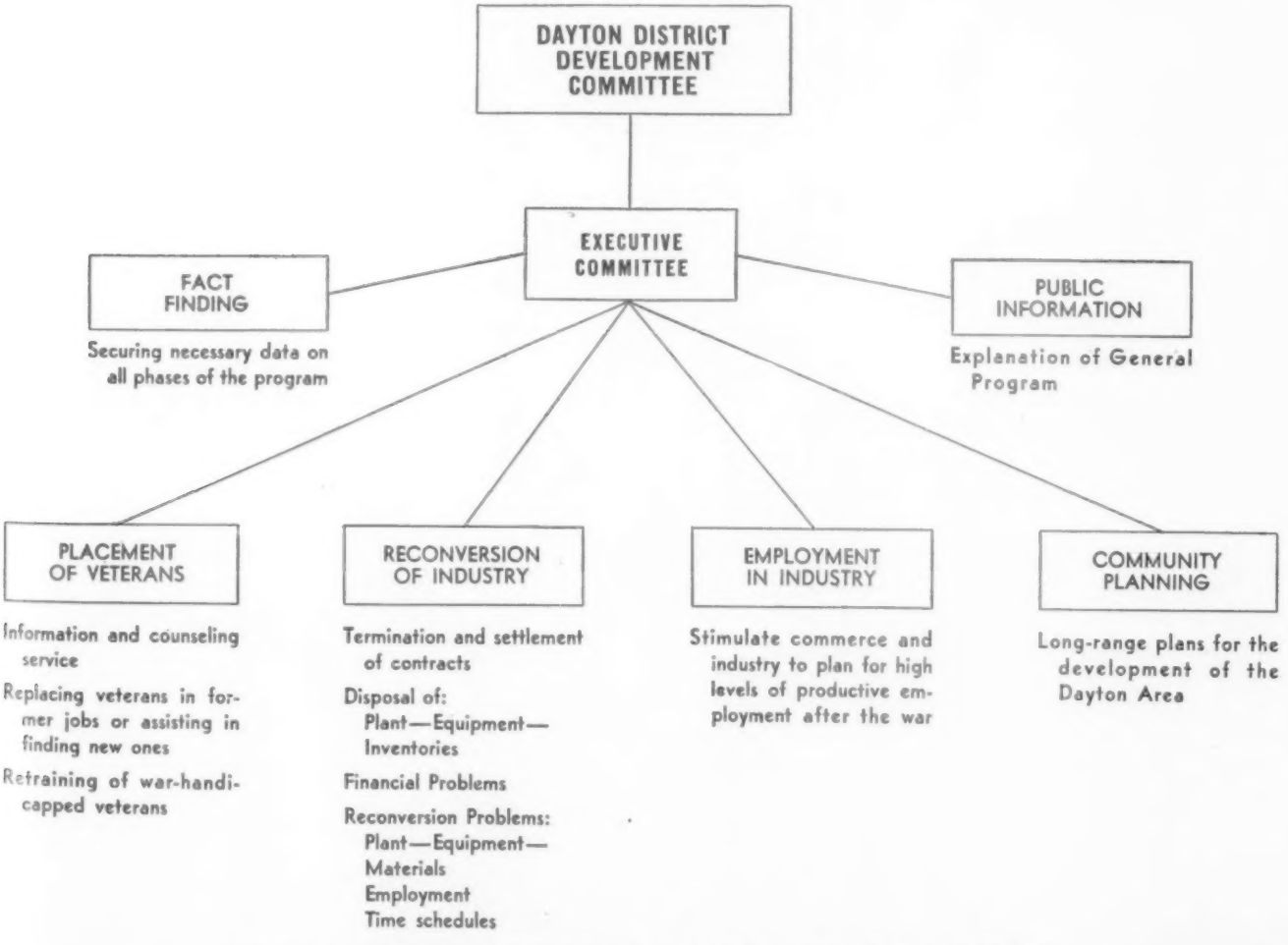

DAYTON DISTRICT DEVELOPMENT COMMITTEE
EXECUTIVE COMMITTEE
FACT FINDING
Securing necessary data on all phases of the program
PUBLIC INFORMATION
Explanation of General Program
PLACEMENT OF VETERANS
Information and counseling service
Replacing veterans in former jobs or assisting in finding new ones
Retraining of war-handicapped veterans
RECONVERSION OF INDUSTRY
Termination and settlement of contracts
Disposal of: Plant—Equipment—Inventories
Financial Problems
Reconversion Problems: Plant—Equipment—Materials Employment Time schedules
EMPLOYMENT IN INDUSTRY
Stimulate commerce and industry to plan for high levels of productive employment after the war
COMMUNITY PLANNING
Long-range plans for the development of the Dayton Area

Fig. 2. Scheme of organization used in Dayton, Ohio, for multilateral planning activity

are needed to reverse existing trends. Most cities cannot afford some of their present trends.

Restrictions and Indifference Bar Cooperation

In 40% of the cities from which responses were received a far less wholesome situation prevails. In fact, there is a general tardiness among these in recognizing the need for and value of formal joint planning, although a few of these school systems and cities are taking preliminary steps looking toward close cooperation. Even among those cities where school and planning authorities do work hand in hand, there are 10 instances where the joining of forces has only recently taken place, as in Cleveland, San Francisco, San Antonio, Denver, and Philadelphia. Among the 25 respondents where no joint planning is being done, 13 are located in the New England and Middle Atlantic states. Only 8 of the 27 cities where close relationships prevail are in this same area.

That some resistance or at least indifference to joint planning exists is shown in a number of ways. Three school officials wrote in emphatic terms that their school districts never have and are not now engaged in joint planning with a city planning commission. It should also be reported, however, that some school authorities would warmly welcome joint planning opportunities, as revealed in this quotation from a letter:

> There is a city planning commission somewhat dormant to which we have submitted our postwar building program, and have asked for their advice and assistance. We have not had any acknowledgment or indication of their attitude in this matter. When the commission becomes more active perhaps we may have a better understanding.

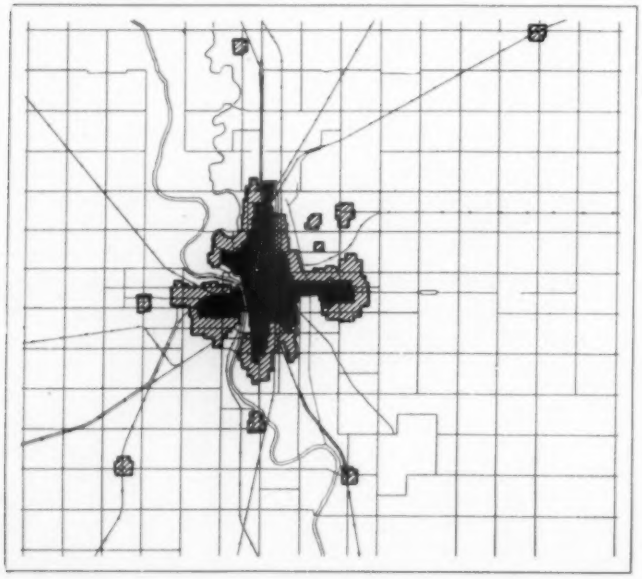
In Minnesota the supreme court has held that Minneapolis school authorities cannot be required to have the approval of the city planning commission for their projects, since education is a state, not a municipal, function. While this decision is undoubtedly correct and follows the dominant line of opinion in upholding state educational authority, it would seem only wise to regard large cities as subdistricts of a state in planning a state-wide pattern of school plants. California law recognizes this in requiring the approval of established planning bodies before school sites may be purchased.

Some professional city planners are themselves partly responsible for the relatively slight importance attached to school plant planning as part of general city planning. One member of a well known firm of city planners wrote: "I don't know precisely what you mean by 'joint planning activities' of school systems and cities." Examination of many reports by professional city planners shows that schools are usually lumped together with parks and recreational facilities, which is sound practice except for the undue emphasis on the latter as compared with the former. This is no new phenomenon. Holy * reported in 1935 that in 25 general volumes on city planning which appeared between 1905 and 1933, 40 per cent made no mention of schools, and in the rest only slight reference to public education was made. Less than one-half of one per cent of the total number of pages related to schools. He also stated that in an analysis of 100 city plans developed during the same period, less than three per cent of the 8,370 pages comprising city planning documents was allotted to schools. Twenty-one plans did not mention schools at all.

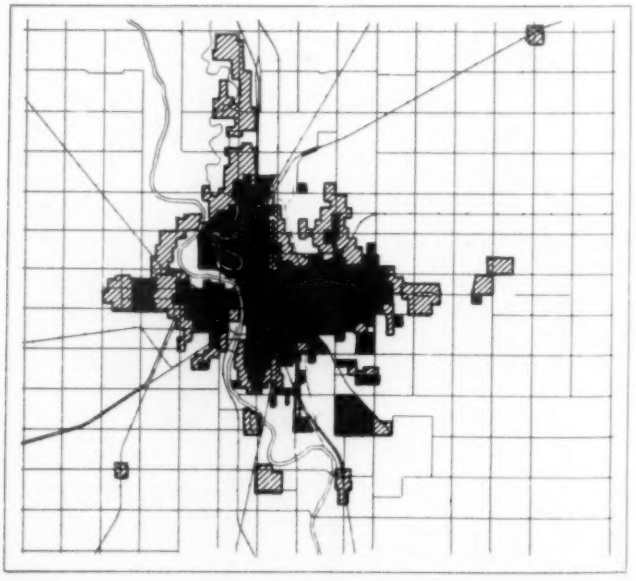
In the early 1944 issues of *The American City* a total of 146 cities reported on the various projects being planned for postwar municipal improvement. Only 21 plans mention schools. The proposed immense Stuyvesant Town housing development near New York, comprising 18 blocks, provides no schools. The mammoth housing projects sponsored by the federal government during the past decade did not provide for educational facilities. Such items are evidence of the lack of attention given to America's most important public service—education—by some planning agencies, in direct contradiction of Engelhardt's principle.

* Russell A. Holy, *The Relationship of City Planning to School Plant Planning*. Bureau of Publications, Teachers College, Columbia University, 1935. (Contributions to Education, No. 662.)

Courtesy of City Planning Commission, Wichita, Kansas. Prepared by Harland Bartholomew & Associates



Wichita in 1921



Wichita in 1943

Yet the wisdom of joint planning is denied by no one reasonably well informed, and what evidence there is seems overwhelmingly to favor it. Every American city has suffered partial deterioration and loss of its assets through lack of techniques to control urban growth and development. Blighted areas are characterized by decreasing property values, an intermingling of urban land uses, obsolete buildings, bad housing, lack of essential services, high incidence of communicable diseases, crime, and delinquency. They cost the cities more in services than is collected in taxes from them.

Many of our school systems are marred by wasteful duplication of school facilities, a mild illustration of which is given in Fig. 3.

Waste Can Be Reduced to Zero

The placement of school plants can, in conjunction with other public services, tend either to arrest or to encourage the centrifugal pattern of urban growth which has for long been a curse of American communities. It has been customary for cities to extend radially all kinds of accommodations, such as streets, sewer and water lines, police and fire protection, and schools. The problem of keeping the heart of the city sound has been neglected. Fig. 4 vividly illustrates the problem of one city, which may be taken as a fairly typical case. The two possibilities shown of the future pattern of Wichita should leave no one in doubt as to which is the sounder. Wise locating of school plants can do much to stabilize the city's population, leading to a high level of civic economy and efficiency, and rehabilitation of those areas in need of redevelopment. A lax planning program or no planning en-

Courtesy of City Planning Commission, Kansas City, Kansas. Prepared by Harland Bartholomew & Associates, Planning Consultants, St. Louis, Missouri

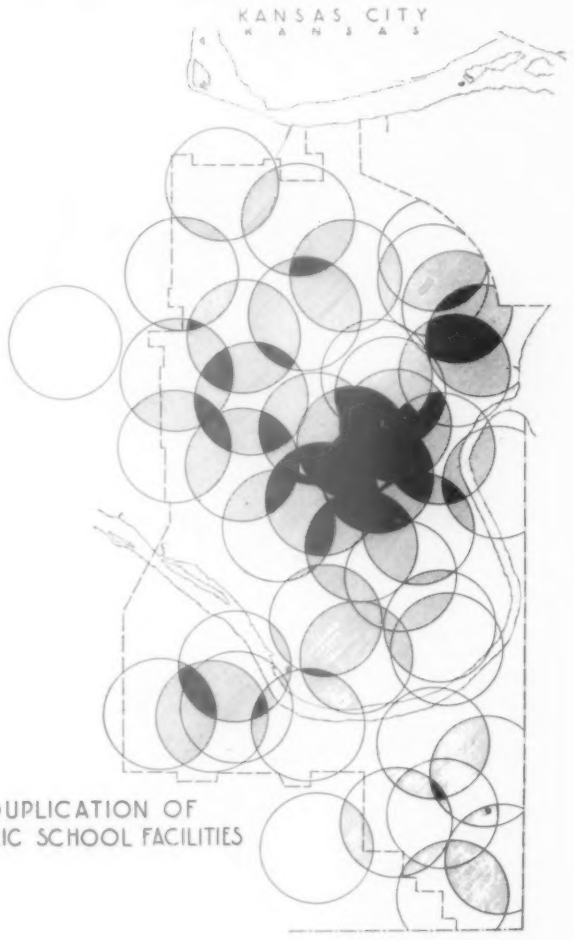
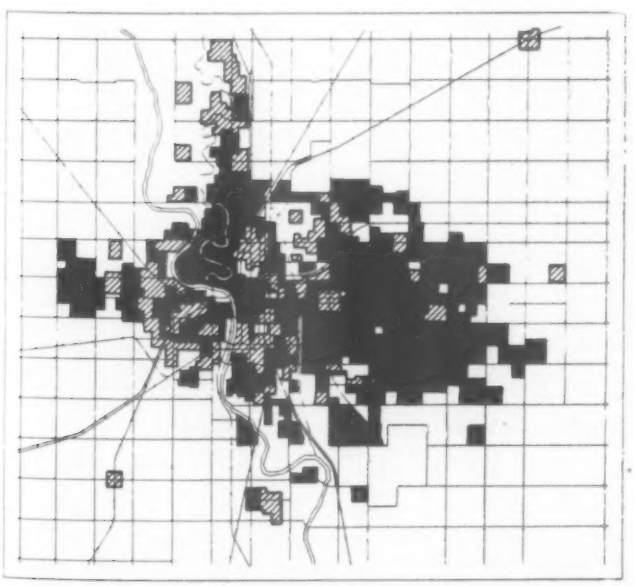
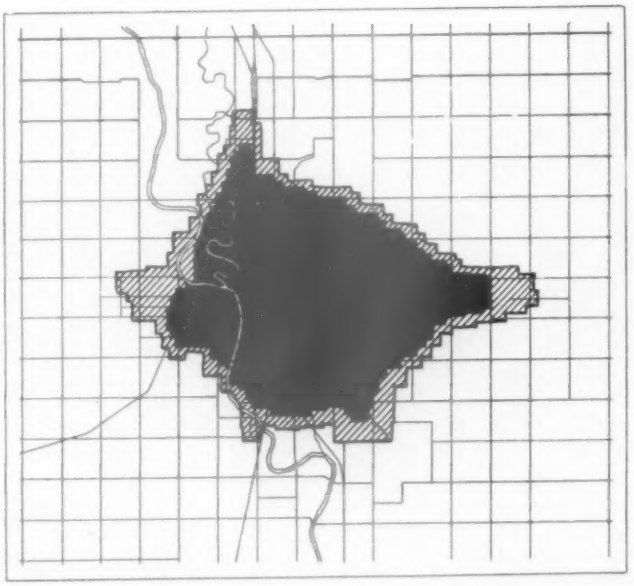


Fig. 3 (right). Example of duplication of school facilities. Circles are drawn on a radius of one-half mile. Each circle indicates area served by one elementary school; hatched section, area served by two elementary schools; cross-barred section, area served by three or more elementary schools

Fig. 4 (below). Pattern of urban growth can be controlled by sound planning techniques and regulatory measures to give them effect. Alternatives for Wichita are shown here



Wichita in 1970—This? . . .



Wichita in 1970—or This?

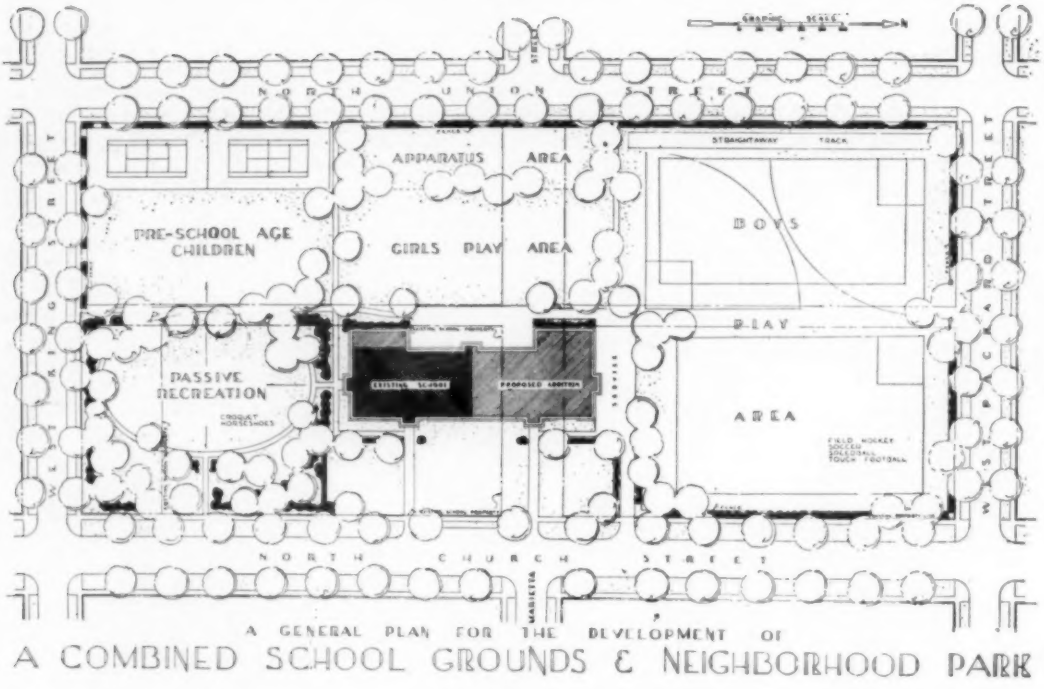


Fig. 5. A five-acre school site planned for use as a small neighborhood playground

courages undue population mobility. This has been one of the oppressive burdens with which school plant planners (and city planners generally) have had to cope.

In October, 1943, for example, the schools of Cleveland had 363 rooms "locked up and out of use" in 71 occupied buildings, plus 36 rooms in three wholly abandoned buildings. This space would house, by a conservative estimate, about 12,000 children, which is 20% of the K-6 enrollment. It is reported that in Pittsburgh there are "a considerable number of elementary buildings today in which the enrollment is approximately 50% of capacity." In all large cities permanent construction of schools has had to be deferred in certain areas until it could be determined whether or not the population was permanent. Lack of sound planning techniques and practices in past generations accounts for many vacant rooms and buildings now—although there are some exceptions to this generalization. In the future such waste can and should be reduced to zero or nearly so.

Schools and Streets

A further illustration of the consequences of lack of sound planning techniques in former periods is the network of major streets and the elementary school locations of Des Moines. Of the 46 elementary centers, 36 are located on or within one block of an existing or proposed arterial thoroughfare. Only two schools are as far as three blocks from an arterial street. Several are located at intersections of two or more arteries. Traffic flow counts (1939) at 19 school locations in winter averaged from 122 to 917 vehicles per hour. The peak hours, 7:30-9 A.M. and 3:30-6:30 P.M., which include the times when children go to and from school, were much higher. Fall and spring counts would have given higher figures. The ideal location now sought, of course, for elementary schools, is an interior position in the area served, so that most of the children do not need to cross major streets.

With sound planning techniques designed to ballast the population of a given area, and with regulatory measures to give them effect, decreased reliance can in future be placed in temporary structures, although in some cases they may still be legitimate for some decades. Ultimately cities should be so well conceived and managed that temporaries will not be needed.

The insistence of city planners on coupling schools with playgrounds is entirely sound. Where existing sites of five or six acres must be utilized, such a development as shown in Fig. 5 is recommended. Larger sites for the dual purpose of providing educational and recreational facilities are preferable.

City Plans Reveal Stress on Immediate Needs

School plant planners today are taking a fairly short look ahead. Very few forecasts of postwar programs cover more than six years, although some short-term plans are supplemented by "deferred" projects. The longest program contemplated is that of Des Moines. This is a 25-year plan prepared by the writer in 1939, which was shelved by the war. It is now being revised and brought up to date.

Another characteristic of a majority of city plans is the large proportion of remodeling of and additions to existing plants, in comparison with construction of entirely new buildings. In Akron, in a total program to cost $5,984,000, additions total $4,275,000, and remodeling $512,000. In Cleveland, a six-year program of $3,595,000 includes remodeling and extensions of present units in the amount of $995,000. In Portland (Ore.), a construction program of $3,800,000 is recommended, of which $1,500,000 is for remodeling and additions, and $1,550,000 for replacements of obsolete structures. In both Pittsburgh and Saint Paul the programs are described as "largely modernization."

SCHOOL PLANT PLANNING AS PART OF OVERALL COMMUNITY PLANNING IN SMALL CITIES

By J. JOHN HALVERSON

Superintendent, Albert Lea Public Schools, Albert Lea, Minn.

VERY few communities have the opportunity to plan their school plant with full knowledge of future requirements from the erection of the first school building down to the latest addition to the school plant. In any city one is likely to find more evidence of unintegrated planning than of plans made in close collaboration with all other community and governmental agencies.

Look Ahead When Selecting Site

A school building must have an adequate site. This site must be found where land is available. At the same time the requirement of being located in a reasonably central place with respect to the school population must be considered. These requirements are most easily met at the time they are least obvious, before the community takes permanent form and reaches its maturity.

A site for a modern high school should include from 12 to 15 acres of land. This will provide playing fields, space for outdoor physical education classes, parking space for automobiles, and the necessary lawns and landscaping to give beauty to the site and to the building. However, in small city after small city we may find that the demands for classroom space has made necessary repeated additions to the original structure until all the available land is occupied by the school building, with the walls rising from the sidewalk line. The playing fields may be remote from the school, accepted by the administration despite misgivings with a "well, it's better than nothing" attitude. Physical education classes which should meet outdoors during fall and spring are fortunate indeed if they can be accommodated in a nearby park.

The only remedy for a school district with a building on a cramped site is to condemn adjoining property and thereby to acquire the additional land needed. There are difficulties in this which are rather obvious. The adjoining property owners can hardly be expected to do less than resist with every means available. This is just what they do, and they can hardly be blamed. Then the public finds it difficult to believe that such drastic means are justified in order to provide play space for a group of youngsters "who might be better off working." The school district that is out of debt is rare. Voting bonds in order to buy high priced real estate for public use does not come easily. The state highway department may cut through fields, orchards, farmsteads, filling stations, and homes and somehow the affected owners often feel that Santa Claus has visited them. Not so when land, especially with homes on it, is condemned for public school use.

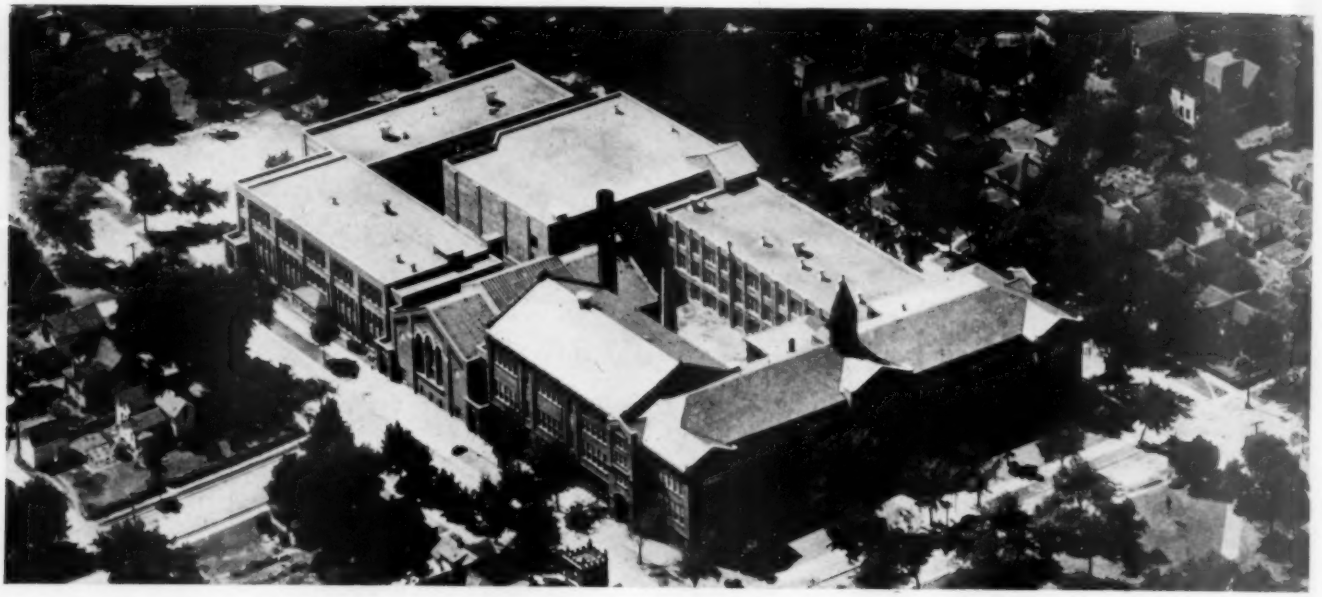
The advice to all school districts planning a school building is that an adequate site be secured before building operations start.

Auto Changes Importance of Central Siting

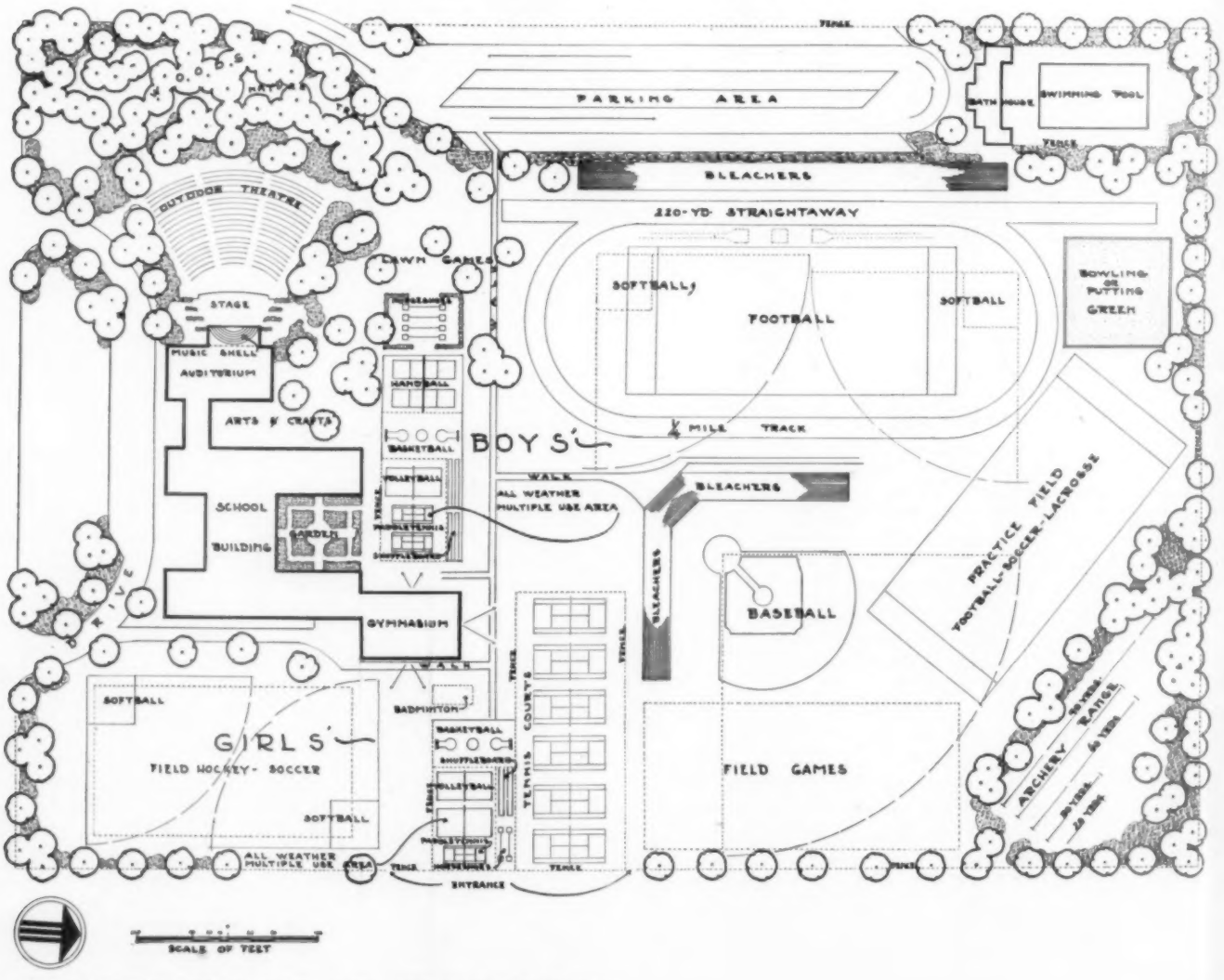
Central location is no longer as important for junior and senior high school plants as it once was. If a pupil walks to school, a few extra blocks may be unpleasant in bad weather. But most schools now have either a cafeteria or adequate lunchrooms, making the walk home at noon unnecessary. If a child rides a bicycle, as hundreds in every school do both winter and summer, a few blocks more make little difference. In normal times many pupils drive cars to school. For them an extra mile or two makes no difference. There is also the possibility that school buses may be provided. Many small cities have public bus transportation.

It would seem that while we still need to give careful consideration to the location of elementary schools, the added advantage of adequate space would in small cities far outweigh the advantage of central location, and indicate that secondary schools might well be located near the edge of the city. This would provide the outdoor space for physical education that is so badly needed in most communities and so sadly missed where it is not available.

When the adults come to the school for plays, con-



A "built up to the sidewalk line" type of building, with no room for outdoor pupil activity. The school receives some relief through its location in a pleasant residential area, facing a park



National Recreation Association, F. Ellwood Allen and George D. Butler, Designers

Study for development of high school grounds for school and community

certs, games, or meetings, they usually drive automobiles. Assurance of an easily accessible and conveniently arranged parking lot next to the building would make for greater convenience in serving the public than would a central location with only street parking available, with the frequent inconvenience of walking several blocks from the remotely parked car in bad weather.

It may be argued that too much attention has been given to the matter of an adequate site, a site large enough to accommodate all the activities of a modern school with some space for lawns and landscaping to add beauty. It may also be reasonable to assume that all school people who have worked in a building crowded on four sides by sidewalks, streets, and traffic, with no place for an outdoor physical education program would welcome a spacious site with room for lawns, tennis courts, soft ball diamonds, archery ranges, running track, and football fields. The entire layout would have beauty and appeal to pupils, parents, and teachers.

Provisions for Adult Use Are Simple

It is assumed that a modern school will be used by adults as well as by children. There is no better way of creating a strong bond between the public and the school than to arrange for service to the citizens in the form of adult education, recreation, meeting rooms, and an auditorium adequate for community needs.

If a building is to accommodate adults, certain aspects of it must be planned with this purpose in mind.

Most of the arrangements needed for the convenient handling of night groups are simple but are frequently omitted from the original plan.

Isolate Adult Use Areas

The first principle to observe is that provision must be made to isolate night groups from the parts of the building which they are not using. Night groups allowed free access to all corridors and all exits can make the night watchman's life miserable, increase light consumption unreasonably, and increase the burden on the custodians the next day.

Corridor gates at proper locations is one step in isolating the areas used at night by adult groups. Strategically located entrances with respect to the areas to be used is another necessity. To light up long corridors between the entrance and the rooms to be used has the same effect as not being able to isolate the areas in use by means of gates. Strategically located entrances together with properly placed corridor gates give assurance that the night groups will use only the areas assigned to them.

Provision must be made for accessible toilet rooms and drinking fountains within the areas. All toilet rooms which are not needed but which are within the areas should be provided with locks.

Cafeteria, Auditoriums, Gymnasium

Where the public may expect to use cafeterias, or other dining room facilities, provision should be made for check rooms or coat rooms. The common lack of these conveniences would lead one to believe that planners of buildings expect people to come to banquets in schools with neither overcoat nor hat.

Every community which has a large auditorium in the school finds that it needs a small one to supplement it. Not every gathering attracts 2,000 people. Some excellent speakers and some very important meetings may attract only 200.

The small auditorium should serve several purposes: as an auditorium, as a social room, and as a room for small dinners. In any event it should have an adequate kitchen attached to it. This auditorium should be definitely planned for the foregoing purposes, not added as an afterthought in an odd corner of the building for which no other use can be found. It should be acoustically treated. The floor should be of material that has decorative as well as practical value. It should be suitable for dances. This definitely rules out the concrete floor.

The stage should be large enough for rehearsals and for play presentations. Small dressing rooms should be available.

The furnishings, seats, piano, lights, stage curtain, and decorating should be harmonious and give to the audience the impression of planning and good taste.

The same rules for segregation of the area and for separate entrances apply to the gymnasium. In addition, separate dressing rooms and showers should be provided for public use. Under no circumstances should public use of the pupils' locker rooms and showers be permitted.

The stage type of gymnasium does not lend itself well to community use. There is no practical way of shutting off the playing floor from the auditorium, and an unsupervised group of visitors sitting in the auditorium often becomes irresponsible and destructive, sitting with feet on the backs of chairs and otherwise defacing the furniture. The conflicts between adult use and pupil use become frequent during periods of class play practice, operetta practice, or other night use of the school.

Rifle Range

A school should include a rifle range. This activity has a very practical value if conducted under the supervision of a person approved by the National Rifle Association. The common use of firearms by Americans and the terrific accident toll from careless handling of guns justifies provision for training pupils in the proper use of and respect for firearms. This is an activity with great appeal for adults. To become an accurate shot with a small bore rifle is difficult enough to challenge the ability of a large group and to hold the interest after more than average proficiency is attained.

Swimming Pool

Wherever the community can afford it, a swimming pool should be included. Since swimming is considered of enough importance to be a requirement for graduation in many large colleges and universities, it should be given serious consideration as a part of the secondary school physical education program.

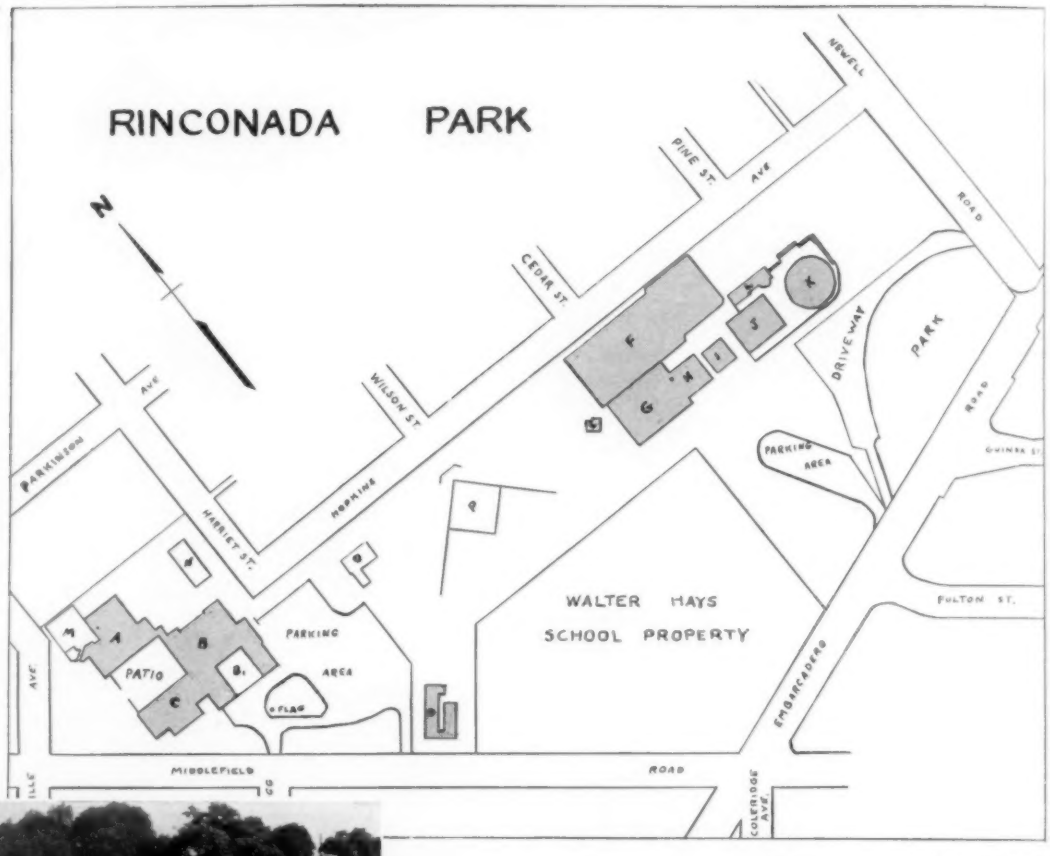
Joint Fiscal Planning Lessens Tax Burden

In any planning program the board of education should work closely with the city government. The taxpayers live in and pay taxes to both school district and city. There are times when each governing body should defer to the other in the matter of adding to the total indebtedness of the city. At taxpaying

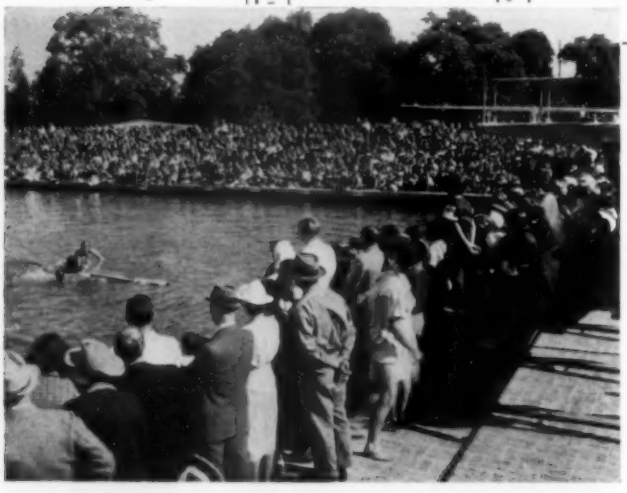
An example of integrated planning, community center at Palo Alto, Cal.

Legend:

A Children's Theater
B Adult Theater
B¹ Open Air Theater
C Social Hall and General Administration Wing
D Junior Museum
E Field House
F Tennis Courts
G Play Pen
H Basketball Court
I Horseshoe Pits
J Swimming Pool
K Wading Pool
L Office and Dressing Rooms
M Boy Scouts
N Children's Library
O Girl Scouts
P Baseball Diamond



Palo Alto Times



Above—Layout of facilities. ". . . charming, irregular group of functional buildings in a setting of green." (See page 45.)

Left—Life-saving demonstration at municipal pool

time the citizens are reminded of the double burden of city taxes and school taxes. New pavement is tangible, so is better city water, or a better system of street lighting. Educational benefits are less tangible. No one can see Johnny's knowledge of physics or chemistry. In the minds of the men who pride themselves on being practical and "getting something for their money" the city council is forgiven first, the board of education last.

It is possible that if the community shares in the use of the school facilities, if the school is adequate, and located so that its beauty and usefulness are enhanced by an adequate site, the public will be as willing to spend money for schools as for pavements. Both are necessary in a modern city. It is also possible that the board of education and city council, even when each is fiscally independent of the other, can plan together, avoiding the pyramiding of indebtedness and yet, by long range planning, achieving both beauty and utility in its public buildings and facilities.

Summary

To summarize: (1) a school should have an adequate site, (2) location of a secondary school in a small city with only one high school may not be as important as it once was, (3) use of the building by the public should be anticipated and proper provisions for its easy administration under adult use should be incorporated into the original plans, and (4) the board of education and the city council should adopt fiscal policies in common, each one considering the needs of the community to avoid pyramiding of indebtedness.

PLANNING ADEQUATE SCHOOL FACILITIES AS AN INTEGRAL PART OF LARGE SCALE HOUSING PROJECTS

By WILLIAM H. COLEMAN

Chief Specialist on School Facilities, Federal Works Agency, Washington, D. C.

PRIOR to the defense and war program, cities and towns usually expanded through the construction of a few scattered houses. As a result the planning of schools for large housing developments was then a non-existent problem. The future planning of our cities will affect school planning to an extent not previously imagined. The present trend makes desirable a review of the changes that have developed in recent years.

A Brief History of Wartime Housing

When it became apparent in the early 'Forties that the nation was to be engaged in a tremendous defense and later a war program, a number of congressional committees investigated the essential concurrent programs. From this developed the Lanham Act which under Title I provided for the construction of hundreds of thousands of dwelling units for the families of men who were migrating to work in new or expanded industrial plants engaged in war production. Title II of this act provided for the construction of essential community facilities, i.e., "Defense Public Works," in the areas where these housing projects were located and in other areas where war activities made such construction necessary. Both of these programs became necessary since the absence of either would have seriously impeded the national defense programs.

Prior to January 1, 1942, the Federal Works Agency had completed or had under construction 152,677 family dwelling units. The program had then become so extensive and so complex that, by an executive order designed to obtain a unified program, the housing functions previously distributed among several agencies, including the Federal Works Agency, were transferred to a new agency. Ascertaining the overall need for dwellings was made the responsibility of the National Housing Agency. Wherever possible they relied upon the home building industry to construct these houses. When loans were required the NHA authorized the Federal Housing Administration to insure such loans. When federally financed housing construction was required, such responsibility was assigned to the Federal Public Housing Authority.

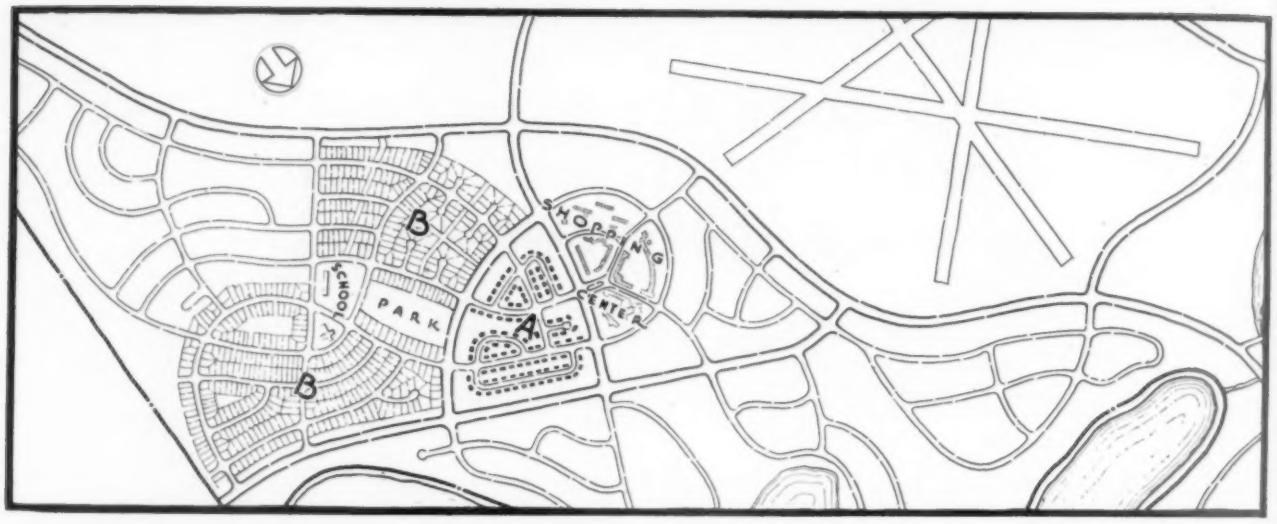
The construction of these dwellings created a need for additional community facilities for the construction of which many localities had inadequate funds. Congress in the Lanham Act assigned responsibility for providing these facilities, i.e., schools, waterworks, sewers, hospitals, recreational facilities, streets, and access roads, to the Federal Works Agency.

By December 1, 1944, approximately 9,000 school classrooms had been constructed or authorized under the Lanham Act. Some of these projects are "non-federal." In these projects, the community contributes a part of the cost, and title to the building passes to the community. Non-federal school buildings are usually of relatively permanent construction and are built where dwellings are permanent and privately owned. On the other hand, when the housing is of a temporary nature, such as the prefabricated demountable dwellings built by FPHA, the schools for the projects are as temporary as the availability of materials permits. Under these circumstances, the title to the building remains in the federal government which, without charge, leases the equipped building to local school authorities for operation. The Lanham Act provides that "no department or agency of the United States shall exercise any supervision over any school"—built with Lanham Act funds, "nor shall any term or condition"—of lease of such school—"prescribe its administration, personnel, curriculum, methods of instruction or materials of instruction."

Because of the construction of war plants and housing, some communities have passed through a period of phenomenal growth. For example in the County of Norfolk, Virginia, which does not include the City of Norfolk, a total of 22,000 dwelling units were constructed. About one-half of these were constructed privately and one-half federally. The resulting school membership has jumped from 6,000 in 1939-40 to more than 19,000 in 1944-45. As is found true in other "young" communities, the school population is still rapidly growing even though all houses have been occupied. Assuming static housing occupancy, this growth will continue for some years.

Factors Affecting School Population

In planning schools for housing projects the first requisite is to determine the scope. This is to be determined primarily by the number of family dwelling units to be constructed. However, it has been found that the number of pupils per dwelling unit is affected in a pronounced degree by the characteristics of the immigrants. It must therefore be ascertained what proportion of the immigrants may be classified as (1) unskilled workers, (2) clerks, stenographers,



Courtesy of The American City

The public housing project in Lake Jackson, Texas, located on a site that was almost a jungle two years ago, was such a success with permanent employees, that the Dow Chemical Company undertook the development of adjoining sections with FHA insured funds. The community plan was worked out in cooperation with FHA land planning consultants. The public housing project is in Section A, the private housing in Section B-B. The operating agency built school and recreation grounds, installed the utilities.

and secretaries, (3) professional, or (4) military personnel.

The scope is further affected by (1) the source of the immigrants, (2) the number of grades in the elementary school (7 or 8), (3) the existence or absence of a well enforced compulsory attendance law and its age coverage, and (4) the number of pupils likely to attend parochial schools. The social-economic status affects the number of children of all ages per family. There are approximately 40 children per 100 adults in the superior class, and about 70 in the very poor class. In regional areas, the number of children varies from 24 per 100 adults in the Far West to 43 in the Southeast. The writer has found the ratio of school pupils per dwelling unit to vary from .25 per unit for projects serving the Washington Pentagon Building to .90 for projects serving the Norfolk shipyards.

Difficulties and Lessons of Wartime Planning

In war construction, it was necessary to meet many temporary conditions that may be disregarded in postwar construction. In postwar construction there will ordinarily be no need to decide whether a proposed school building is to be constructed as a "temporary" or permanent building. The exigencies of the war made it necessary for the War Production Board to change from time to time the material that could be used in the construction of a building. During the first years of the war no iron or steel was available because of the huge quantities used by the Army and Navy. As a result, most schools were built of wood. Later, wood became scarce and cinder block construction was substituted. In late 1943 steel again became available.

The scarcity of material affected design and function as well as longevity. Few library rooms were placed in elementary schools regardless of size of building. Large auditoriums and gymnasiums were completely eliminated and replaced by a "multi-purpose" room. The latter, with an adjoining kitchen usually served also as a cafeteria. This multiple use of rooms "made possible by the use of acoustical materials, movable furniture, and resilient floors," is probably a permanent contribution of the war period to small school buildings.

One factor of uncertainty in school planning during the war—predicting probable high school enrollment—will continue to provide difficulty in the postwar period, even though the net effect will be reversed. The wartime problem was caused by the lowering of the draft age and the attraction of high salaries or the possibility of rendering patriotic service in war work. In some cases the shift was so great that it was possible to avoid all necessity for high school construction by transporting secondary pupils from housing projects to vacated rooms in existing high schools. Often a high school building already constructed on a housing project was converted to elementary school use. In the postwar period, when demand for labor slackens, many former pupils will return to complete their schooling, and pupils coming up from the elementary grades will remain, thus increasing the need for secondary accommodations in the years immediately following the war.

During the war, because engineering firms were occasionally given a minimum of time in which to prepare plans for emergency housing projects, essential community facilities sometimes received little if any consideration in the project plan. Occasionally sites for schools were entirely omitted. At other times sites were set aside that failed to comply with state laws as to area, sanitation, and drainage, and also failed to meet the requirements of state and local school codes in other respects. Good site planning for schools is a collaborative enterprise which requires from the beginning the participation of state and local school authorities. If this procedure is not followed, proposed sites may again be found located in "borrow pits," or on steep declivities where cost of construction is prohibitive and suitable playgrounds entirely lacking. If the site is located on the seacoast,

the playground may be adequate during neap tides but disappear into the sea during spring tides.

How to Plan Postwar Projects

In future planning of schools for large scale housing projects the following principles and procedures should be observed:

1. Planning of large scale housing projects should involve the collaboration of local and state school authorities and specialists on school building construction.

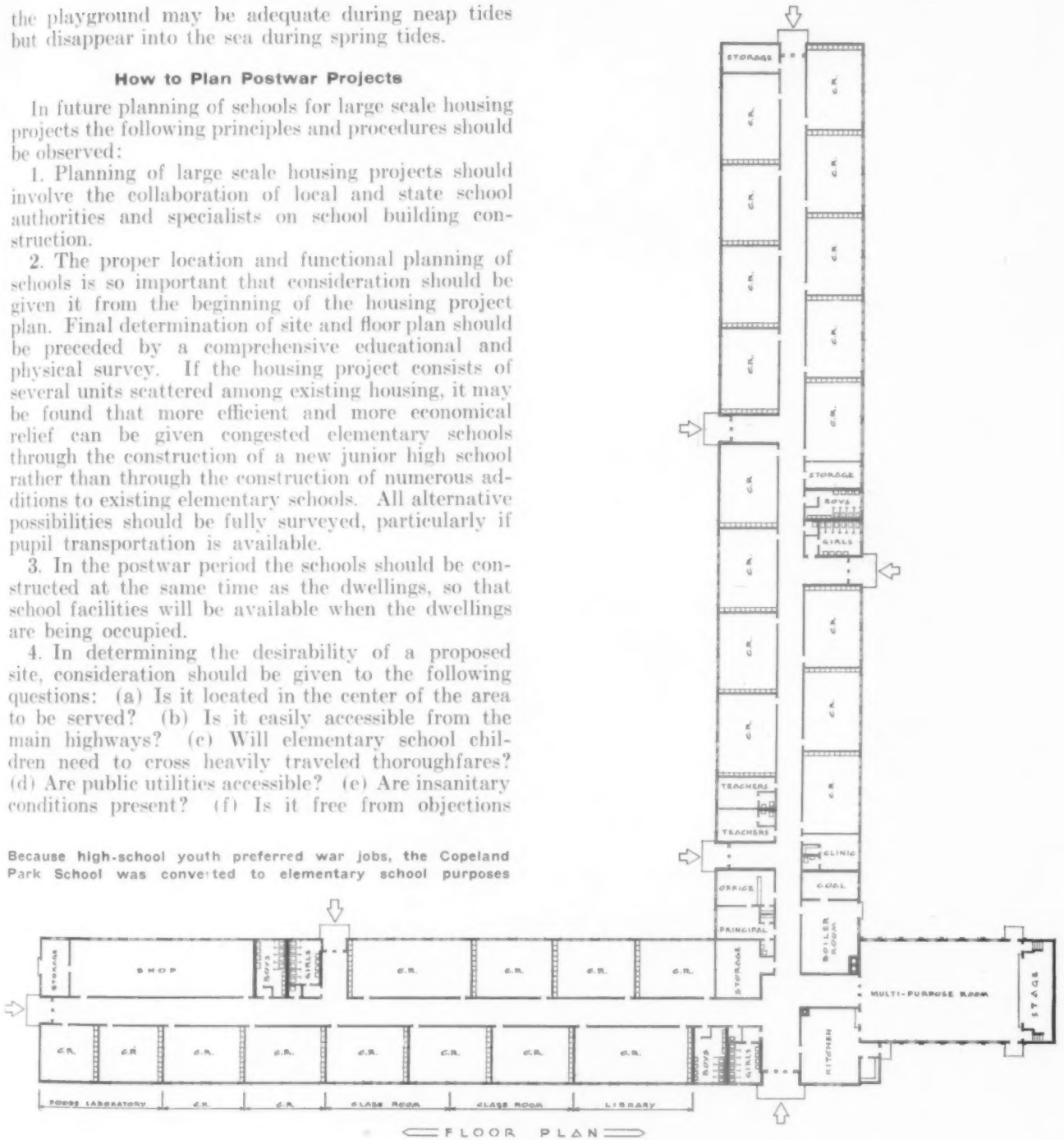
2. The proper location and functional planning of schools is so important that consideration should be given it from the beginning of the housing project plan. Final determination of site and floor plan should be preceded by a comprehensive educational and physical survey. If the housing project consists of several units scattered among existing housing, it may be found that more efficient and more economical relief can be given congested elementary schools through the construction of a new junior high school rather than through the construction of numerous additions to existing elementary schools. All alternative possibilities should be fully surveyed, particularly if pupil transportation is available.

3. In the postwar period the schools should be constructed at the same time as the dwellings, so that school facilities will be available when the dwellings are being occupied.

4. In determining the desirability of a proposed site, consideration should be given to the following questions: (a) Is it located in the center of the area to be served? (b) Is it easily accessible from the main highways? (c) Will elementary school children need to cross heavily traveled thoroughfares? (d) Are public utilities accessible? (e) Are insanitary conditions present? (f) Is it free from objections such as odors and noises? (g) What is the location of the high school with respect to the proposed site of the commercial area or shopping center? (h) Is the size adequate?

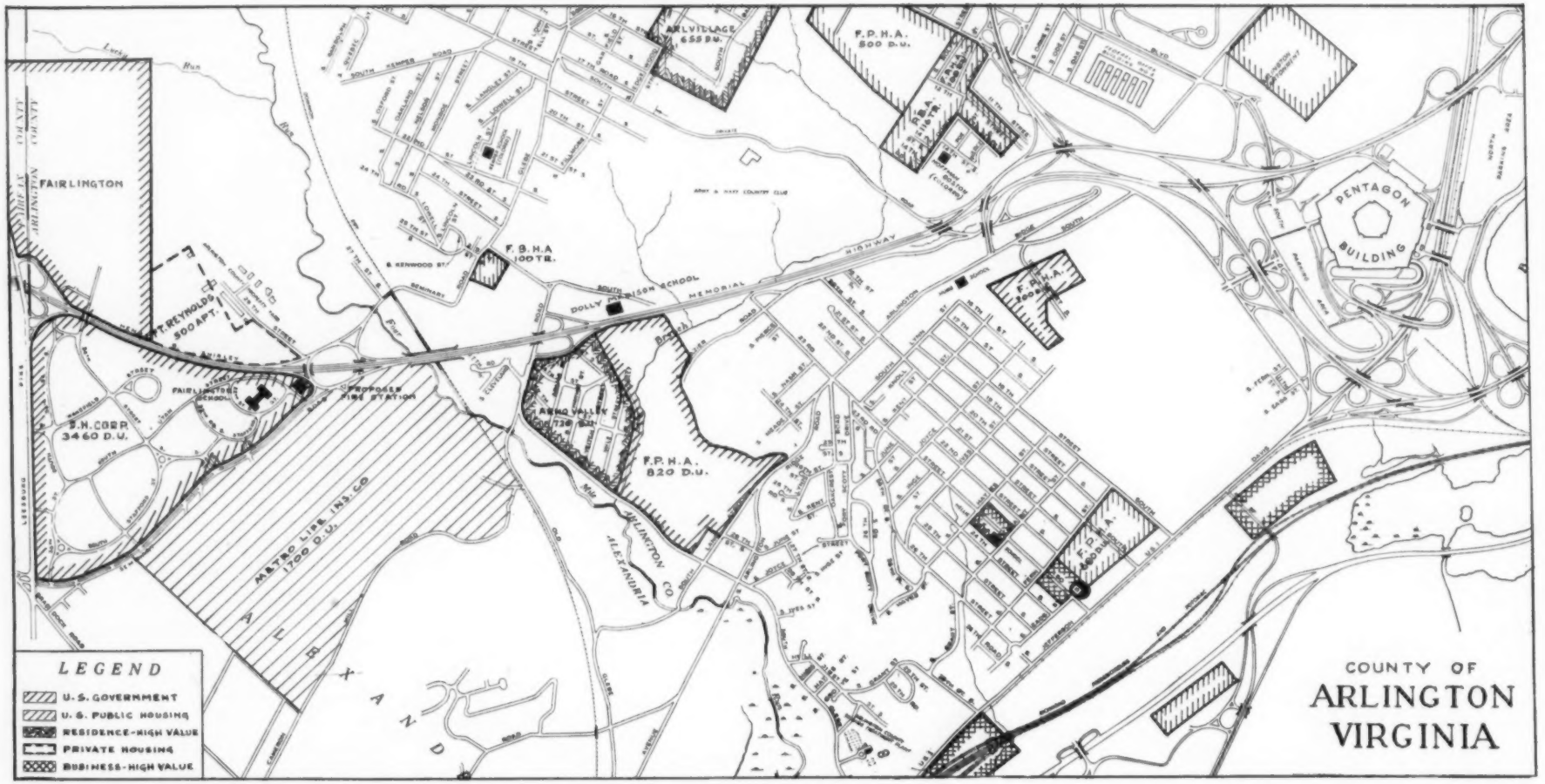
5. Public officials should be held responsible for requiring that preliminary plans for large housing projects include an adequate school site. At least three-eighths of an acre per classroom should be allotted for the site. Of this, one-eighth of an acre is required for the site of the building (single floor), for walks and landscaping around the building, and for the parking of cars. About one-fourth of an acre per classroom is to be reserved for exclusive playground use.

6. Buildings and playgrounds should be planned for use by the entire community. This affects the



Because high-school youth preferred war jobs, the Copeland Park School was converted to elementary school purposes

COPELAND PARK SCHOOL
DEFENSE HOUSING PROJECT
NEWPORT NEWS, VIRGINIA.



Map showing section of Arlington County in which are several large housing developments, private and public. Represented are projects of the Metropolitan Life Insurance Co., the Defense Homes Corporation, the Public Buildings Administration, the Federal Public Housing Authority. Note location of schools indicated by small, solid black squares. In planning schools for housing projects, it is important to determine the number of family dwelling units, the number of pupils per family (which can be deduced from the socio-economic status of the family), and the existence or absence of a well-enforced compulsory attendance law and its age coverage

arrangements for heating and the placement of auxiliary rooms.

7. School buildings should be utilitarian in design. Careful consideration should be given to the local pattern of instruction, so that the building may facilitate essential educational procedures. Many school buildings contain excessive areas for purposes other than instruction. The objective should be to keep to a minimum the original cost and the cost of maintenance. It does not "make sense to spend 25 per cent of the educational dollar on halls and stairways." A pleasing appearance should be sought through simple esthetic architectural design rather than through excessive ornamentation.

8. Planners should make provision for immediate school needs. However, buildings should be extensible to allow for the inevitable expansion of school needs in a "young community." A copy of the plans, including future extensions, should be kept on file in the local school offices and with the proper state authorities.

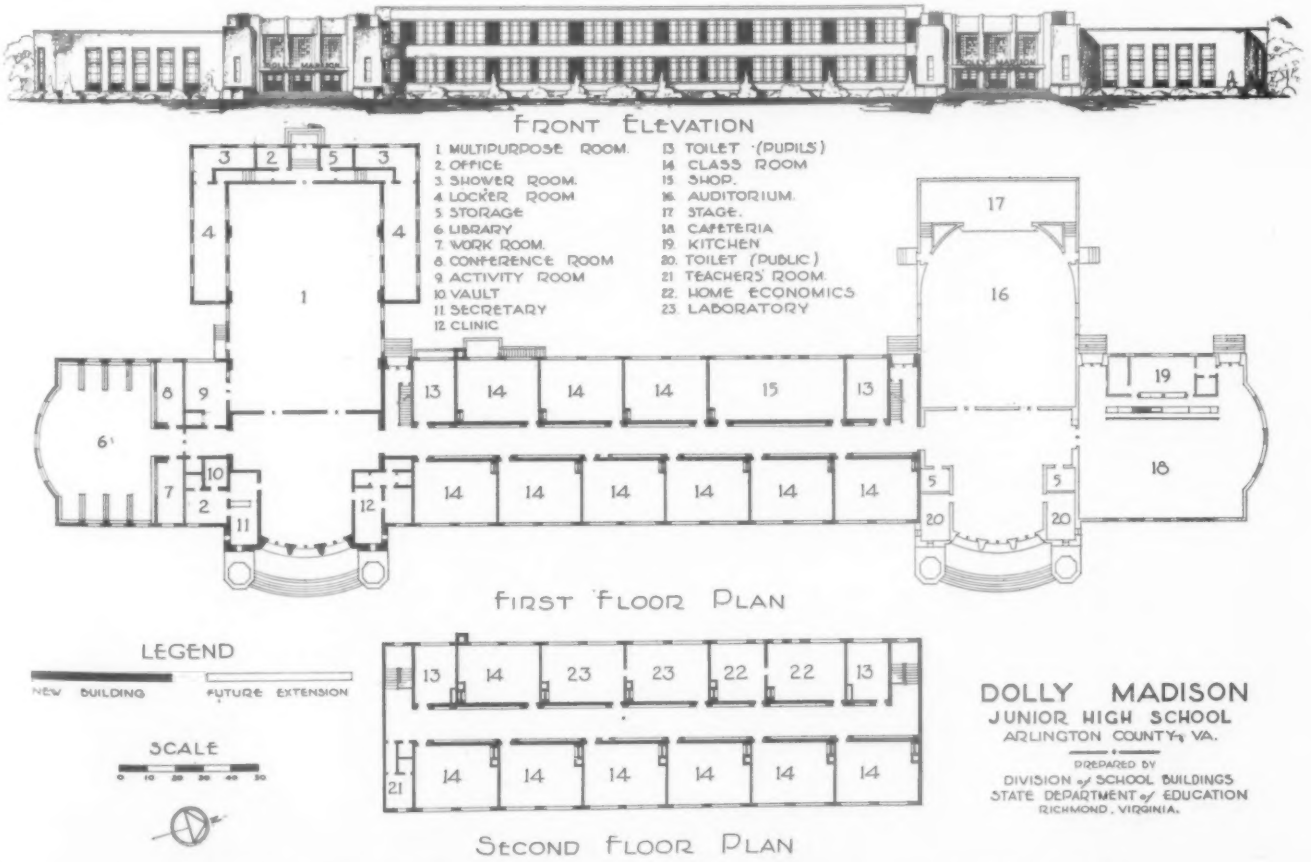
9. Postwar construction of schools in areas where there are 12 grades and a kindergarten, and a compulsory attendance age of 16 or more, will need to provide for a school membership of .5 to .9 pupils per dwelling unit, depending upon the type of occupant as indicated in the foregoing discussion.

10. Some postwar planners have decided, from what appears to have been a careful scientific study, that from a school point of view a project of from 1500 to 3000 dwelling units is desirable. For the 3000 dwelling unit project a detailed determination has been made as to the community need for churches, theaters, shops, markets, restaurants, drugstores, beauty parlors, barber shops, and offices for doctors, lawyers, realtors, and insurance men.

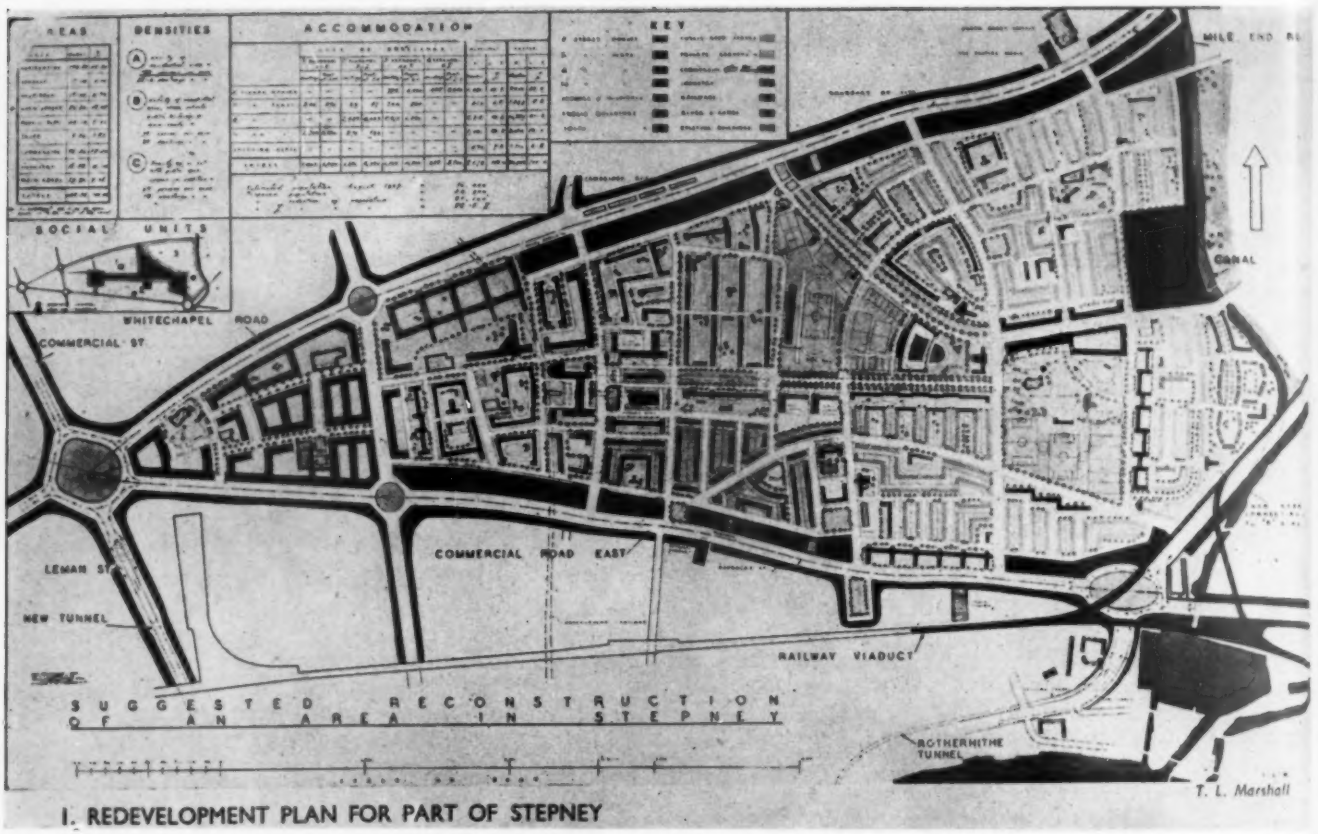
11. A project of 3000 units in a community of varied occupations will require two elementary schools of 20 rooms each, for kindergarten to grade six, and a combined junior-senior high school of 32 classrooms, including laboratories and shops, for grades seven to twelve. The high school would include in addition, an auditorium, gymnasium, library, cafeteria, and other auxiliary rooms. This number of dwelling units will require an area of about 960 acres which would measure one mile by one and one-half miles. In this theoretically ideal community, few elementary school children would need to walk more than three-quarters of a mile to school and few high school pupils more than one mile.

Dwellings Without Schools Have Poor Market

It is quite clear that in the transition stages of the house construction program many developers, both private and public, failed to comprehend the seriousness of omitting schools as an integral part of the housing project program. Only when it was found difficult to rent or sell constructed dwellings lacking school accommodations was the importance of this phase of the program fully realized. After the war it should be considered the responsibility of both developer and school authorities to see that adequate school facilities are planned as an essential part of each large housing project.



In a young community, buildings should allow for the "inevitable expansion of school needs"



I. REDEVELOPMENT PLAN FOR PART OF STEPNEY

Courtesy of London County Council Planning Authorities for County of London

The County of London Plan proposes to superimpose over much of London a series of integrated communities

EDUCATION AND THE EVOLVING CITY

By CLARENCE S. STEIN

Architect, New York, N. Y.

A NEW urban pattern is evolving to take the place of our decaying cities. Our school system promises to play a guiding part in the emerging form.

That a new conception is developing is apparent in the proposed plans of the County of London and of the City Planning Commission of Los Angeles. They both accept the neighborhood and the district as the basic minimum units of the pattern of civic life and of physical redevelopment. In both cases the area of neighborhood and district is set in large part by the areas of influence of the elementary and secondary schools. A similar scheme formed the basis of the 1928 plan of the new town of Radburn. It has been followed in the building of various large wartime housing developments.

Neighborhoods in a Democracy

The automobile made the gridiron-patterned city obsolete. The steady flood of traffic submerged neighborhoods by cutting them into diminutive rectangular islands separated by dangerous streams of movement. In the city, the last vestige of physical form of neighborhood disappeared just when the developing economy of plenty was at last giving a surplus of leisure and a renewed desire for healthful community living.

What is a neighborhood in a democracy? It is not merely a place—it is a society. It is a group of people or families living together and having common interests in which they take an active part. The active participation in common interests is that which differentiates the democratic community from all others.

To make possible the development of the democratic spirit and the fellowship of neighbors, the neighborhood must have definite, recognizable physical form. It must have apparent boundaries that separate and differentiate it from other neighborhoods. It must be small enough to permit friendly association of its inhabitants and active participation of all members in common concerns, but large enough to allow a varied community life and to support adequate community facilities economically. The centers for the common interests and local activities are the market, the school, the playground, and hall for holding dances and other gatherings.

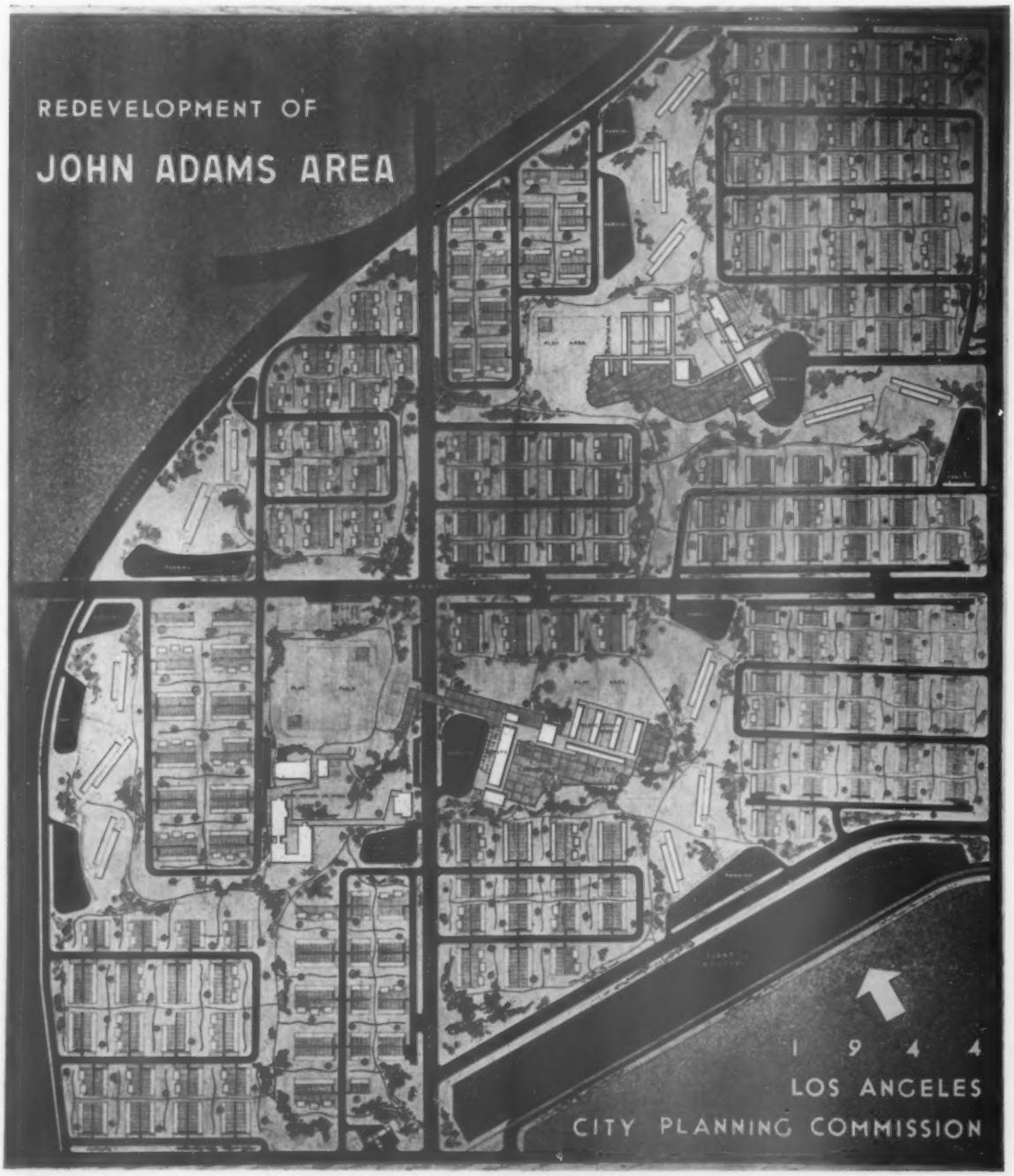
In contrast, the colossal metropolitan city submerges the individual; his influence on civic activities

that affect his welfare is too distant to arouse his interest or pride in results. The endless repetition of similar rectangular blocks divided by a monotonous gridiron of streets offers no definite boundaries that set one neighborhood apart from another. The checker-board pattern presents no setting of dignity or repose for the housing of the common activities of the neighborhood. Schools, libraries, play spaces, and stores are all spotted in unrelated lots that one passes but never approaches. As a result, people, particularly those with children, are vacating the old centers in search of a more spacious community life. They are leaving the nineteenth century cities to gradually rot and decay.

It is apparent that those dying cities that hope to be resurrected must in large part be rebuilt. They must be redeveloped and according to a new pattern.

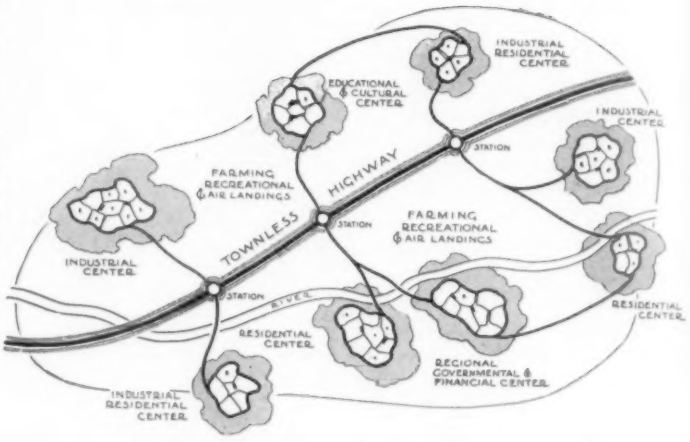
The neighborhood community forms the natural minimum unit of this new pattern—as the individual lot and block did of the old. A group of neighborhood units can be consolidated into a town or, in a large city, into a district, for carrying on major activities —secondary schools, hospitals, or health center—more effectively and more economically.

If all members of a community are to have the opportunity of taking part in forming its policies and carrying out its activities, the neighborhood unit must be limited in size. It must be cut off from the dangerous flow of quck-moving traffic. Speedways that are going places must go around, not through, neigh-



An example of the proposed rebuilding for the John Adams area. Blighted areas would be replaced by neighborhood communities forming districts focusing on the high school community center. Pedestrian paths over or under secondary traffic streets would connect the neighborhoods

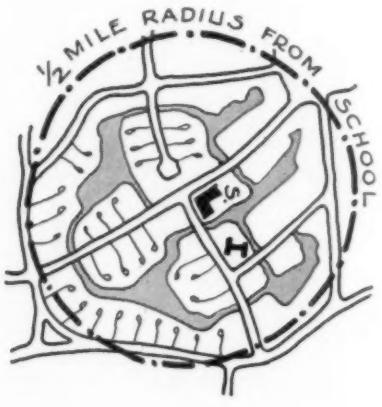
Right—The REGIONAL CITY consists of a group of towns which, in aggregate, should be large enough to support economically the essential equipment of a modern American city. Each community, in addition to its residential function, may serve one or more specialized functions required for the group—industrial and commercial, cultural and educational, finance and government, entertainment and recreation. Community character is permanently established by a surrounding protective area of natural green. The open spaces between communities are kept permanently open for their related uses as farmland, recreation area, or natural woodland. Because the unit of scale of the regional city is the free, safe use of the automobile and the airplane, the residents of any community within the city are as near in time to the other communities and to the open spaces between them as the residents in the outlying areas of the sprawling metropolis are to the center



Diagrams by the author, courtesy of Pencil Points

Above—The TOWN or DISTRICT is composed of one or more neighborhoods separated by open green spaces, but bound together by secondary roads. Size depends primarily on predominating interest or need—usually high school community center—and on the most workable and economical organization for that function

Below—The NEIGHBORHOOD is the natural basic planning unit which permits the greatest economy and freedom in the layout of blocks, streets, shopping centers, schools, recreation spaces, houses. It centers around communal interests, whose focal point is the elementary school. Ultimate size of each neighborhood may be measured by the number of families whose children will fill an efficiently run school. Each neighborhood requires well-defined borders to preserve and protect its unity and special character. Topographical limits or planted areas may determine these



borhoods. Quiet, peace, safety must be the characteristics of neighborhood life if our cities are to survive.

Above all, a neighborhood must have a center, a focus for neighborhood life. There is a practical need of bringing together the varied common activities of a neighborhood. There is convenience and economy in the common use for varied ages and activities of auditoriums, playgrounds and other spaces and equipments. Broadening usefulness and coöperation will grow out of such joint use. It is more economical to have a single adequate parking area, a common heating plant, a single competent engineer superintendent, and possibly a centralized administrator to operate the whole plant.

Beyond all this, there is a spiritual need of forming a neighborhood center. A comprehensive, integrated group of buildings in a setting of spacious green will serve as a symbol of the neighborhood unity—a place around which pride of community will develop into active democratic participation of all the neighbors—young and old. In such a setting the spirit of the old New England village with its church and meeting house, its school and its store grouped around the village green, can be revived. There will be equal beauty and graciousness in the buildings and in their relation to the shape of the land and to its best use and attractiveness. But the structures will take new forms in harmony with our changed habits of community life and our increased technical abilities, as well as with the varied local tastes and regional background.

Schools, Basis for Neighborhood Area

It is recognized that the educational system will play a determining part in forming the new city pattern. The greatest common tie in an American community is the school. Every family has a very direct interest in the public school. Even if it does not have children in attendance, more than half of local taxes, in most places, go to the support of education. Besides, many parents choose their living places on the basis of the reputation of the schools.

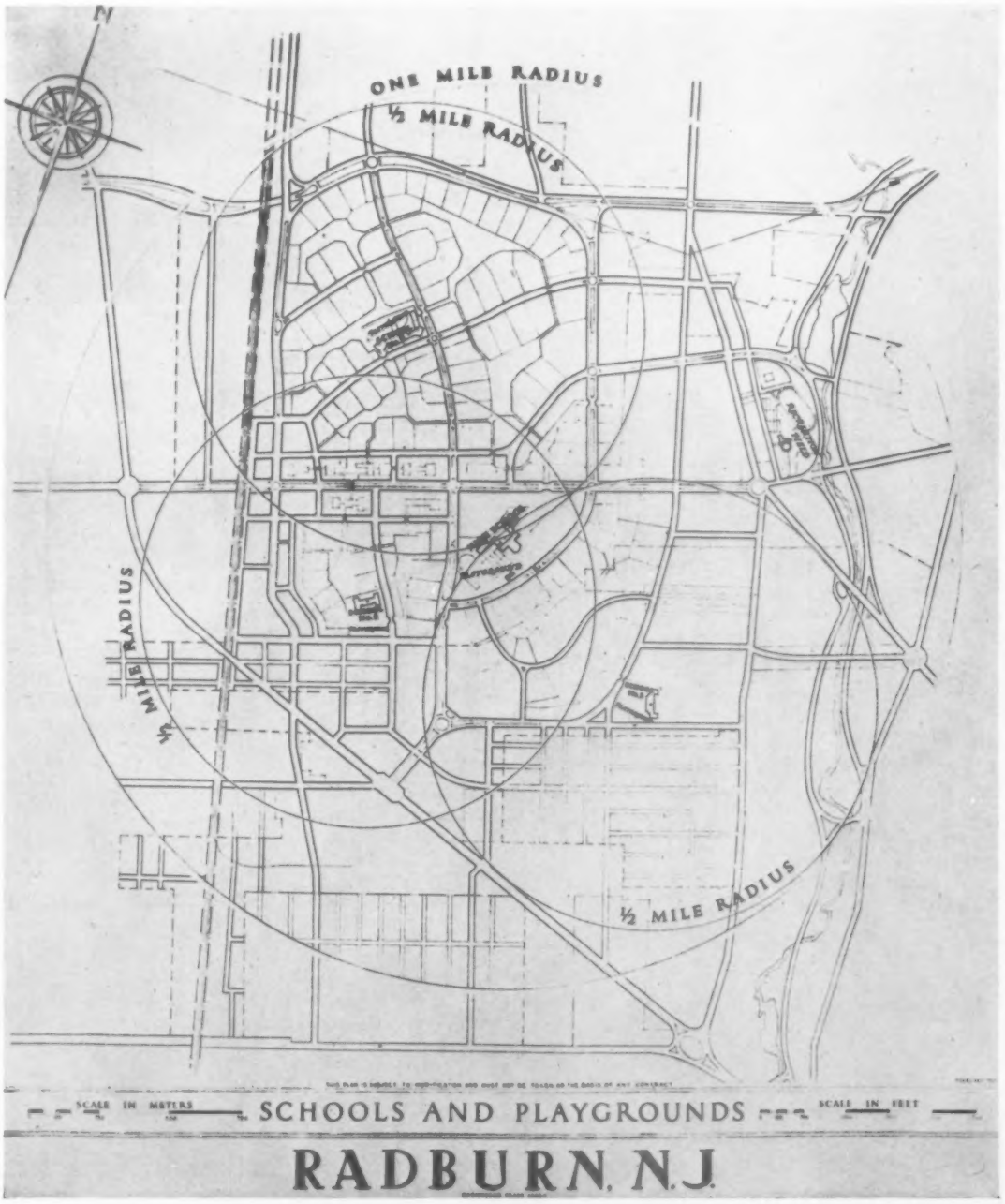
The area and size of neighborhoods and districts will probably be based on the number of children re-

quired for effective elementary and secondary schools. The distance that children will walk from home to school is the maximum radius of influence of the elementary school-community center. The location of schools will decide the placing of other community facilities, which will be integrated with the school into community centers.

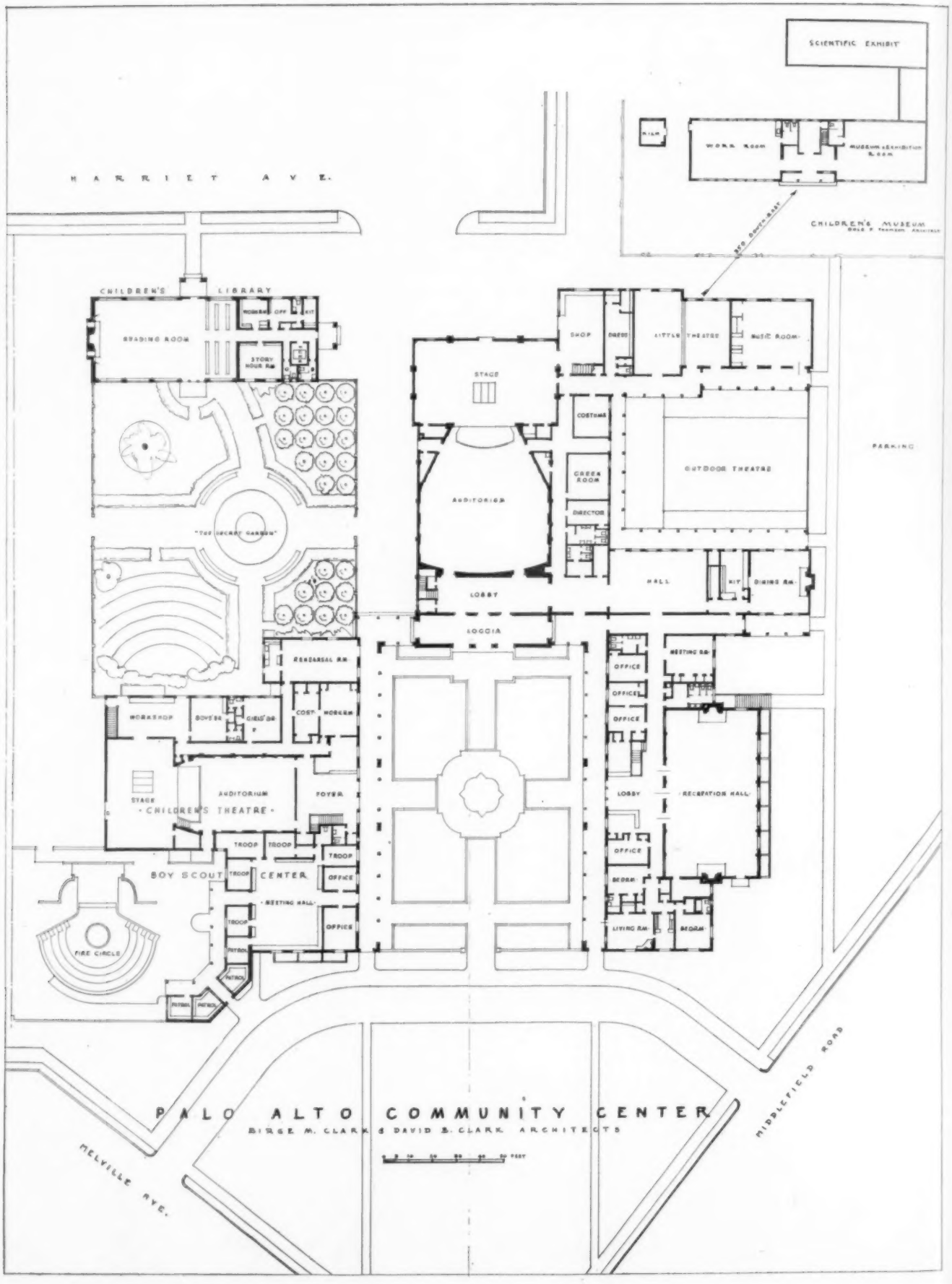
Who Is to Lead?

But the fact that the educational system will take a leading rôle in setting the new pattern does not necessarily mean that the schools will dominate the other elements. It is possible that a great error in tactics may be made by civic-spirited educators who attempt too hastily to amalgamate all local community activities into and under the administration of the school. Coöperation, rather than domination, may be wiser in the period of evolution of neighborhoods and districts as social, as well as physical, integrated entities.

It must be recognized that there are other public institutions that have long established points of views of their own. There is the public library system, for instance. Many leading libraries claim that their underlying policy is different and possibly preferable to that of the schools. The public libraries, open to all, try to emphasize the freedom of the individual, young as well as old, to enter and depart at will. There is no compulsion. The open shelves are an indication of this attitude. The two little boys in Saroyan's movie, "The Human Comedy," who were not able to read and yet were welcomed by the librarian to stroll past the



Radburn, N. J. Clarence S. Stein and Henry Wright, city planners. Radburn, built in 1928, was designed on the basis of three neighborhoods, each centering around a school community center. The high school, with the larger recreational area and town community center, was intended to form a main focus for the town. The organization of neighborhoods and larger communities proposed for Radburn has been followed in the Greenbelt towns and in our larger war-housing developments


SCIENTIFIC EXHIBIT
WORK ROOM
MUSEUM & EXHIBITION ROOM
CHILDREN'S MUSEUM
HARRIET AVE.
CHILDREN'S LIBRARY
READING ROOM
STORY HOUR RM.
"THE SECRET GARDEN"
STAGE
SHOP
DRESS
LITTLE THEATRE
MUSIC ROOM
COSTUME
AUDITORIUM
GREEN ROOM
DIRECTOR
OUTDOOR THEATRE
PARKING
LOBBY
HALL
KIT.
DINING RM.
LOGGIA
REHEARSAL RM.
WORKSHOP
BOYS DR.
GIRLS DR.
COST.
WORKRM.
OFFICE
OFFICES
OFFICE
MEETING RM.
STAGE
AUDITORIUM
CHILDREN'S THEATRE
FOYER
LOBBY
RECREATION HALL
TROOP
TROOP
TROOP
OFFICE
BOY SCOUT CENTER
MEETING HALL
OFFICE
BEDRM.
LIVING RM.
BEDRM.
FIRE CIRCLE
PATROL
PATROL
PATROL
PALO ALTO COMMUNITY CENTER
BIRGE M. CLARK & DAVID B. CLARK ARCHITECTS
MELVILLE AVE.
MIDDLEFIELD ROAD

Entrance to Children's Library, Palo Alto, California, Community Center

stacks and enjoy the sight of books is characteristic. The school represents to the adult—as a result of his recollection of years of dominated activity—the place of *must*—of action under the will of others—and too often the will of a distant power—the regulations of a board of education that does not know his neighborhood or its customs and desires. So librarians do not want branch libraries to be absorbed or dominated by schools.

The librarians in some communities feel that, in many ways, they offer a better leadership for other community activities and particularly adult education. Adult education started in the libraries as part of the subscription or club libraries of the middle of the last century. The tradition of informal education has continued to the present. It draws to the libraries a great many grown-ups that are not influenced by the schools. Of them, Alvin Johnson says:

> The library is their own institution. . . . They need not fear that difficult requirements will be imposed upon them in the way either of attendance or of specific performance. They would look upon a course given under university auspices as something handed down to them, while a course under library auspices arises and develops under their own initiative. . . .*

Although most libraries no longer agree with Andrew Carnegie's idea of the '90's that the library is the natural center for all cultural activities—music, exhibits, forums, etc.—nonetheless many libraries feel the need of offering to their neighborhood a place for free community activities. An example is the little theatre in a library in Harlem, New York, where a successful Broadway show was first tried out.

Recreation departments have also developed community centers. Since the beginning of the century these have been built in connection with playgrounds. In Palo Alto, California, one of the most progressive small municipal centers in America is under the leadership and technical direction of the Department of Recreation rather than that of Education. Here again, volunteer action is emphasized—in contrast to the rigidity of the schools. The Palo Alto center consists of a charming, irregular group of functional buildings in a setting of green. There is a community theatre. There is also a Junior Museum for exhibits not only of scientific and artistic objects from the outside world, but also of the block prints, sculpture, model boats, sketches, and illustrations made in the studios and shop housed in the Junior Museum. There are Girl Scout and Boy Scout centers. There is a Children's Library—a welcoming, homey place. But best of all—most active of all—I found the Children's Theatre. Here some 800 children gather each month on their week-ends not only to play actors, but

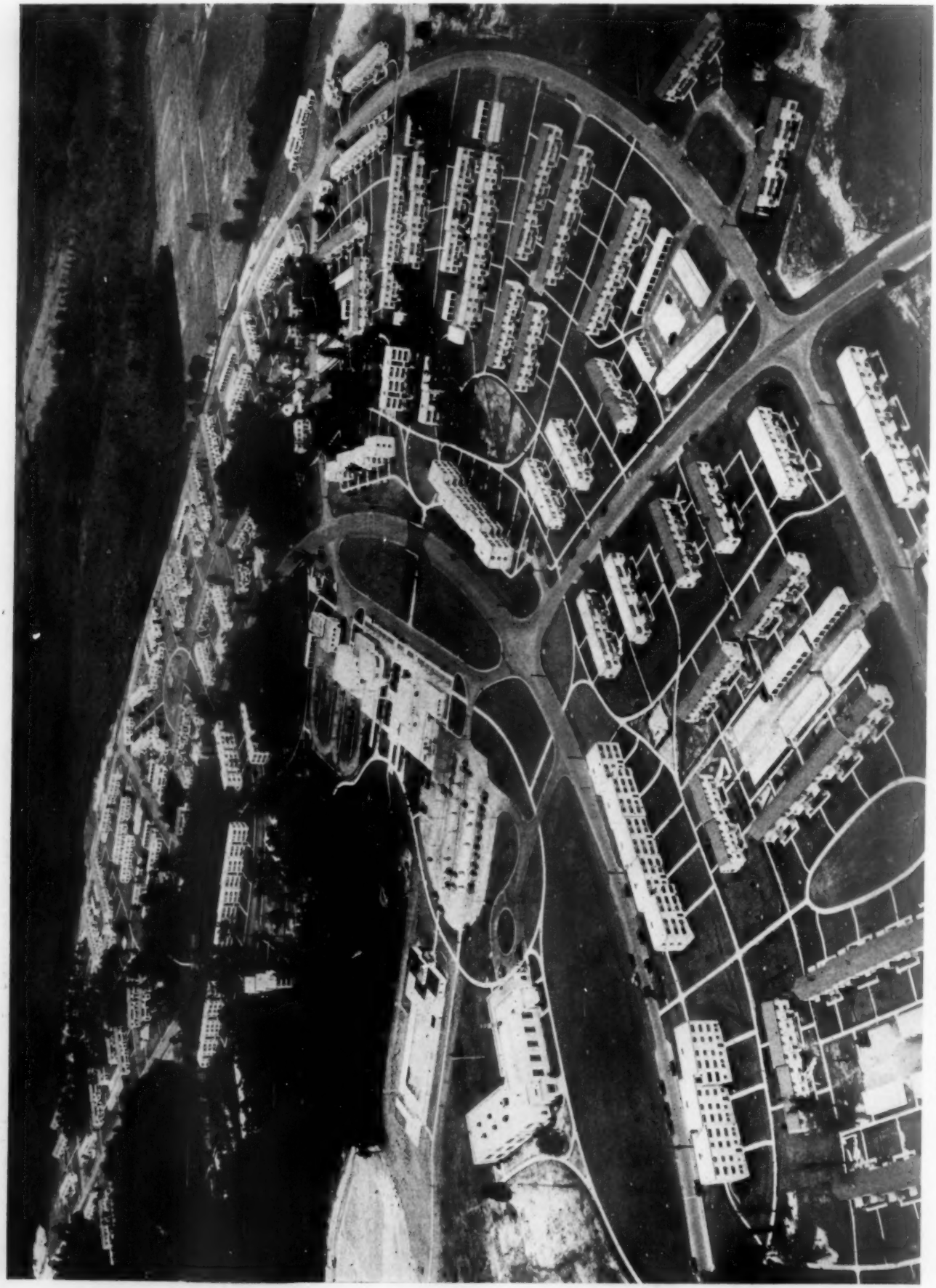
* "The Public Library—A People's University" (Chicago: The American Library Association, 1938), p. 51.

Above—Outdoor Theatre, Palo Alto Community Center. This theatre utilizes the workshop, costume room, dressing room facilities of the adjoining Adult Theatre

Left—Children's Theatre, Palo Alto Community Center. This wing, just as complete as the Adult Theatre, is situated on the Secret Garden, a walled-in area for outdoor productions, story hours, and garden parties

Right—Adult Theatre, Palo Alto Community Center. The Adult Theatre is complete with workshop, rehearsal hall, costume room, prop room, green room, dressing rooms, and offices

Below—Junior Museum, Palo Alto Community Center. Here take place "exhibits not only of scientific and artistic objects from the outside world, but also of the block prints, sculpture, model boats, sketches, and illustrations made in the studios and shop"



Greenbelt, Maryland, satellite town, designed to meet needs of motor age. Community building is social and educational center

to make costumes and scenery. Every one comes of his own free will. There is a feeling of good companionship between the children and their instructors. Mrs. Robertson, who has directed the activities of the Children's Theatre since its foundation, also teaches in the schools from time to time. She finds that the attitude of the pupils in the schools—even of the same children that go to the Children's Theatre—is quite different. They are more formal and rigid. They speak to her as "Teacher" or "Miss" instead of calling her by her first name.

Much the same attitude toward study is apparent on Saturday morning at the Art Museum in Toledo, Ohio. The Art Institute opens its doors—and its heart—to the youth of Toledo. It's their museum for the day. No child has to come to paint or draw or sculp. But a thousand do come each week. In the basement are big workrooms and studios. But most of the youngsters prefer to ramble and to work in the galleries above. They lay flat on the floor and paint. They climb up on the benches. They have a grand time. When they grow up they will go freely to the museum—its monumental structure will not awe them. But the school as community center—there their thoughts may go back to the place they had to go to and all those regulations and don'ts.

I got some impression of that feeling from a group representing the various clubs in a large private housing development in New York City. When I planned this apartment house community, called Hillside Homes, some nine years ago, I made the big playground and the recreation rooms the center of the group of dwellings. The question as to whether there should be a large auditorium was decided by the fact that we had sought a site next to a school—both for the convenience and safety of the children and so that the adults might have the use of the auditorium. So in spite of the fact that the development has some 5,000 inhabitants, its main recreational room is of moderate size. I was warned that difficulties might be put in the way of adults wishing to use the school auditoriums—custodians are powerful and sometimes tyrannical folks. But I said, if 2,500 or more voters can't use pressure enough to get access to all the schoolhouse has there is something the matter with our democracy or our ward politicians. But how has it worked?—I asked the Council of Clubs at Hillside after almost a decade? "Oh, we use the school auditorium when we have to—for big meetings. We don't like to—we don't feel at home—too many regulations. And when the talk is over they put us out. Now, here in our little auditorium we feel more comfortable. We stay on to dance and drink."

Example of Good School Leadership

I do not want to give the impression that there are not many schools to which the neighbors go freely and joyfully. But this is only the case where there is leadership on the part of a principal or a superintendent with broad community understanding and experience. It is perhaps too much to ask that the principal teacher at the same time be the principal leader of the community. Most of them have not the time; others are not equipped for the community job. Another difficulty in large cities is the tendency towards uniformity under the administration of a central administration. As a result, the varied local viewpoints of different neighborhoods are obliterated and the ability of even a public-spirited principal is negated. There is much better opportunity in small communities for such leadership.

An outstanding example of this is the Henry E. Huntington School at San Marino, California, which was described in the 1943 Edition of THE AMERICAN SCHOOL AND UNIVERSITY. Under the leadership of Elmer Neher, the superintendent, the school was planned as a group of one-story buildings around a series of open courts. Not only is it one of the best examples of modern school planning in close relation to the out-of-doors, but at the same time it offers one of the most complete plants for the use of the community as a whole. It serves as a gathering place for all types of town activities—meetings, lectures, concerts, dances, and even for banquets of various civic associations. A branch library under a separate administration and in a separate building has been located in close relation to the school group. The play field, which is under the direction of the Recreation Department, has been planned as an integrated part of the group in close relation to the gymnasium. This integration is not merely one of plan. The assistant recreational director in charge of the playground is, at the same time, the head of play activities for the school. Coördination such as one finds in the Huntington School indicates the relations between various elements that should form the basis of postwar community center plans.

Evolution of School as Neighborhood Center

The conception of the school as a community center for adults as well as children is not new in America. The scope of these activities was greatly broadened and enriched during the decade before the war. This was due in part to the financial assistance of the federal government through the WPA and other agencies. It was also the result of the growing community consciousness of the need of continued education and recreational activities for all ages as part of fuller and more varied community life. The functions formerly carried out by privately endowed centers directed by philanthropic outsiders, such as settlement houses, tended to become municipal cares and, in some localities, to become part of the educational department's work. To bring these elements into the set pattern of school programs and administration was no easy task. Above all, the inflexible structure of old school buildings restricted, if they did not prevent, the all-day use of the school plant for satisfactory educational, recreational, and social programs. New buildings were required to meet these new needs.

Some school buildings were designed in the beginning to carry on the double function of school and community center. Excellent examples are those of the Greenbelt towns built by the Resettlement Administration under Rex Tugwell. The federal government financed the construction. The Resettlement Administration induced the local authorities to take over or coöperate with the town in operating these educational institutions broadened in activities far beyond that of the program of the local school district. Greenbelt schoolhouse in Maryland has a large multi-use room that is used not only for community dances, parties,

Courtesy Museum of Modern Art, New York

School-Community Center, Woodville, California, built by the Farm Security Administration for migrant workers. Vernon de Mars, architect. The well-integrated group of simple functional buildings permits separate entrance to and administration of the school

and assemblies, but even for a town fair. Greenhills, Ohio, has made the local public library a related part of the school (both elementary and secondary). The school of Greendale, Wisconsin, though designed some ten years ago, is one of the most complete and useful buildings for a rich and varied all-age program.

A different type of school-community structure was developed by the Farm Security Administration for its migrant workers' towns. There was little money to spend on these buildings which were fully used only during a limited season. Nonetheless, the Administration wanted to give the families of the migrant agricultural workers an opportunity for an enriched community life. The difficulty of the problem challenged the ingenuity and common sense of Vernon de Mars, the architect, and his associates.

The community-school of Woodville, California, which burned down a short time ago, was a fine example of the type of free and logical planning as contrasted with the fixed, inflexible, monumental construction of the stereotyped schools of the past. It points the way for planning school community buildings for this age of evolving urban relations.

During the depression, much progress was made in development of community centers in public housing developments. Club rooms, multi-use rooms, play rooms, nurseries and shops were designed with some study of functional uses and integration of parts. This was valuable experience, even though misguided economy and standardization without consideration of local diversified requirements or adequate understanding of future needs limited their continued usefulness. For instance, the stereotyped multi-use room intended for such different uses as auditorium, gymnasium, dance hall, was generally a hybrid that served none of its functions adequately.

The integration of school and other community activities made increased progress as a result of wartime activities. Even within the obsolete structures of the past, the pressure of wartime need has forced

broadened community services. Schools have been used for training for war industries, and for soldiers and sailors, for Red Cross bandage centers, for draft board meetings, for nurseries and day care. However, such uses of the inflexible monuments designed for quite different activities are makeshifts. The obsolete structures will have to be replaced in time with clearer articulation of the various elements, each designed for its special purpose and joined to the others so as so permit changing relations and evolving function.

The building of complete new communities for war industries has given us an opportunity not only to make use of new and modern street patterns and coordinate neighborhood plans, but also to experiment with the planning of school-community centers that would serve all of their varied functions more adequately and fully.

The temporary nature of most of the wartime communities had a definite advantage. It permitted experimentation in the form and relation of the elements, that is, of school, nursery, health center, public assembly hall, meeting and recreation rooms, playgrounds, administrative offices, and moving picture house and shopping facilities.

It is true that the passion for standardization of the housing bureaucrats limited the possibilities of exploration and experimentation. But in the best planned of these community centers, such as those at Willow Run and at Chabot Terrace, Vallejo, the architects studied their problem from the ground up. They considered the desirable activities of all members of the community and attempted within a limited budget to serve them adequately. They were not restricted by inflexible obsolete buildings. They did not have to cramp new needs into old forms. They may have made mistakes in judgment, but they attempted to build functional and articulated structures. They designed these so that the various parts could be managed separately under different administrations, such as the housing authority and the school authority. But they linked them together so that all parts might be easily accessible. They integrated them so that elements such as the great hall might serve an all-day use for various activities, school assembly, town meetings, community theatre, etc. They grouped the simple elements to make an effective whole without monumental pretentiousness, so that all the neighbors might have a justifiable pride in their town hall or neighborhood center.

The Future—City Plan

Out of these tentative experiments of the depression and war much has developed that will help us in the great task that faces us . . . that of creating new cities or rebuilding the old to meet the need of a changing world. Our great difficulty is that we must build of solid materials for a society that is in process of change, to meet ideas that are still in process of conception. We envision new cities that will better fit our abilities and our aspirations, but at the same time we find that the experts in every department disagree as to the requirements.

The planner's job is no easier than that of the tailor who attempts to cut a lasting suit of clothing for the adolescent boy growing into manhood.

But in spite of limitations, the big job of planning must proceed. For this is our great chance to break down the prison bars of an obsolete city pattern and to replace the static monuments of past practices. This is our opportunity to create forms that will more closely fit our needs and that will, at the same time, offer possibilities of growth and expansion.

There is much we still have to learn about the creation and remodeling of cities to serve our changing needs. But this much is clear and may serve as a basic program.

1. *Neighborhood communities* should be built small enough so that every inhabitant can take a personal part in their activities. They should be large enough so that they can support adequate equipment with efficient administration for a full and varied community life.

2. *Their growth* should be limited by natural boundaries to preserve the neighborhood's identity and character.

3. *Towns or districts* should consist of a group of neighborhoods, consolidated so as to carry on facilities too large for a single neighborhood, such as high school, hospital, community theater.

4. *Regional city* should be composed of a constellation of small or moderate-sized towns (or communities), separated by great areas of natural green, but bound closely together by "townless highways" or parkways.

5. *A community center* should form the focus of each neighborhood and each town or district. The

Adult using community school library, Greenhills, Ohio

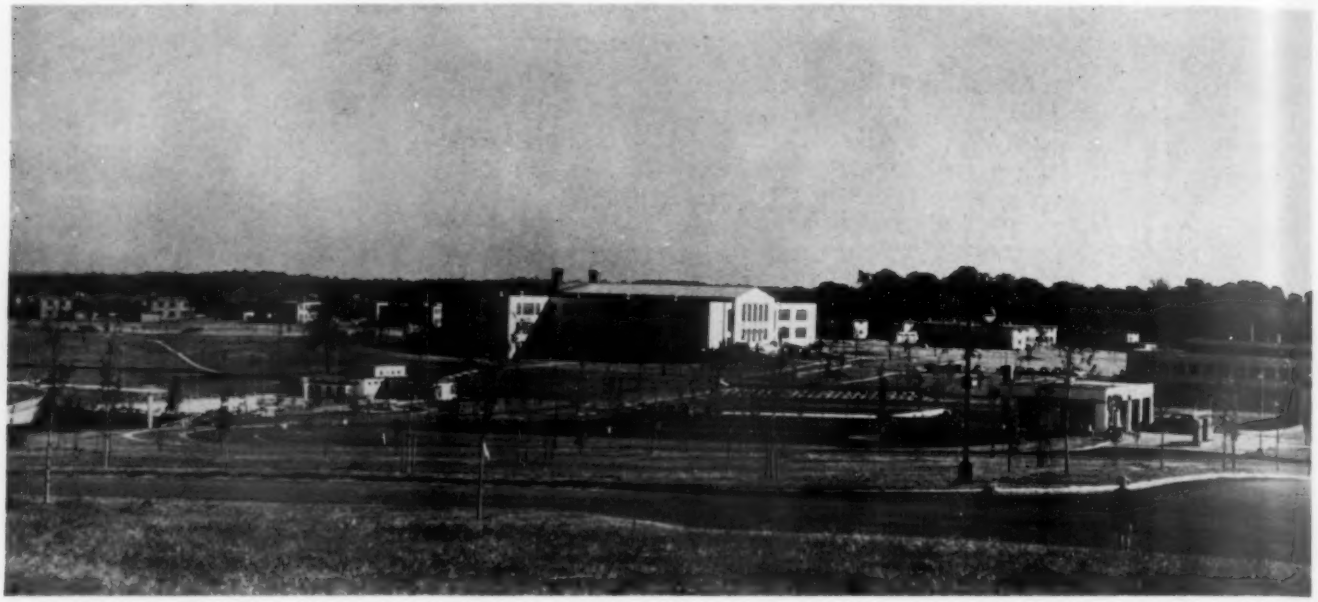


Photo by John Vachon

Greenhills, Ohio, a community planned by the Suburban Division of the U. S. Resettlement Administration. The swimming pool, community center, and business district seen from a short distance. The school-community building, planned by Roland A. Wank and G. Frank Cordner in 1937, remains one of the most effective and attractive community centers in the United States. Town meetings, forums, dances, dinners, take place here

functions and the character of each of these will differ, depending on the predominant common interests of each community and its people. Each will be conditioned by the degree of leadership and coöperative spirit of the different activities: the school (elementary or secondary), the health center, the library, the recreational center, etc. As a result, the plans and architectural character should be varied to reflect local character and different requirements.

But there are certain characteristics that all of these centers should have. These will differ fundamentally from the community architecture of the past.

These differences, in large part, grow out of the fact that we are living in a period of rapid evolution —or is it revolution? There is just one thing we can be sure of in the future, and that is change—continuous change. So, the first requirement is that architecture and plan must be flexible. It must be capable of change, development, growth, without undue expense or waste. This is fundamentally opposed to the old idea of solidity, permanence, building for the centuries and to serve fixed and stable institutions.

Architecture in a Changing World

If our architecture is to be a free expression of progressive thinking, we should aim at as complete flexibility as possible. Ultimately, I hope we shall have not only movable partitions and readjustable mechanical equipment, but even movable units of buildings. . . . As completely flexible freedom as that which Kump has secured under war conditions, in his admirable temporary schools in California, may be difficult to attain in other climates and under other conditions. But our aim should be clear:

Impermanence rather than monumentality must characterize the architecture of a world in flux. In monumental buildings, standards must be fixed over a long period. This, in a changing world, leads to a stifling of growth or to quick obsolescence. If material change is to keep pace with developing ideas at minimum cost and waste, we must have:

Functional and articulate architecture with a minimum of extravagance and superfluities. Plan and structural shell should fit the activities that are required from them at all time. No ancient rules of architectural relations and balances should limit the use of today and the possibility of change and evolution.

Coördination of the various elements of a community center—schools, nurseries, theatres, libraries, health centers, etc.—should permit complete functional independence of each element and at the same time the common and varied use of structure and space, such as a large assembly place.

The educational systems with inflexible regulations and mental outlooks can be only gradually broadened and integrated into a wider social institute to serve all the elements of the community. Community centers must be built with sufficient flexibility so that material changes may simply and economically keep pace with changing ideas. They must permit the close physical relationship of the school with educational responsibilities for children only for a limited part of the day, with other social and educational activities for all, all the time. This physical tie must be made without interfering with the free and separate administration of clinic, kindergarten, library, community meeting rooms, clubs, and other social or adult educational units. This coördination should be open to an evolution and variation in use and administration that will permit experimentation and growth.

Spacious surroundings are essential if there is to be change and growth. There must be room around the buildings for parks and parking—plenty of it. And,

above all, there must be adequate space for unpredictable expansion and the evolution of new requirements and changing programs of community life. Essential growth in the past has been crippled or prevented by lack of adequate open space. In many of the war communities the needs of additional community facilities have developed very quickly. In most cases, space for growth, change and expansion had not been preserved. The result has been additions at a distance—more costly in operation and difficult of supervision.

The grouping of the buildings should be such as to form simple but beautiful gathering places in regard to which all the neighborhoods will have pride and loyalty. The unique characteristics of each center will foster this *local patriotism*.

The character of the architecture should grow out of the local conditions. It should reflect local customs, local taste, local governmental operation. Climatic and site conditions should differentiate the architectural form and appearance of the community centers of various neighborhoods and towns in different parts of the country. The architecture of this period of evolution must be a live architecture. It must bear the impression of the difference of regional conditions. And above all, it must show the imprint of the variety that will develop in every local community if there is real opportunity for the expression of the individual as part of the community.

We must beware of the generalized standardization that comes from misdirected centralization. Let the standards of the experts in education, health, etc., be a guide, but not an immovable mold that will imprint the similar mark of distant regulations on every neighborhood and town.

Condition of Individuality

Each neighborhood should have a unique quality reflecting the special point of view, the habits, and characteristics of its people. These local differentials, if they are to be real reflections of the interplay of expert direction and understanding and local thought and activity, must grow out of two main principles:

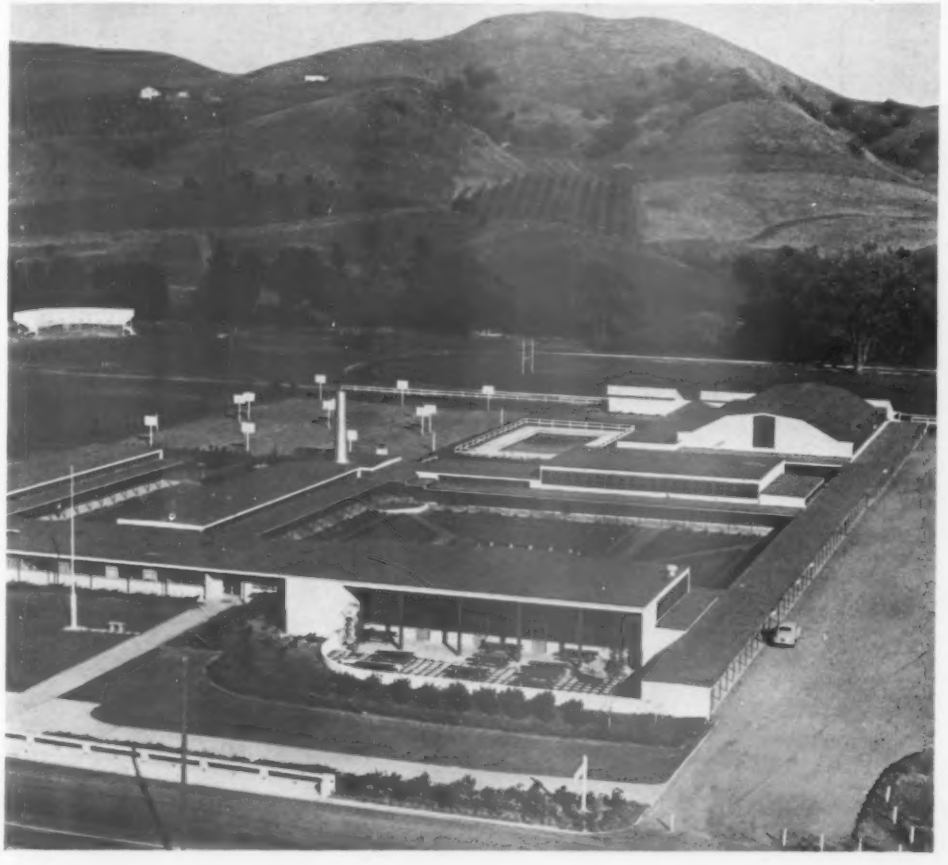
First, there must be an architecture and grouping that is fluid, flexible, articulate—with spacious surroundings that will permit unending growth and evolution.

Second, there must be opportunity for the true expression of democracy in action. Grass-root democracy requires participation of all in their common affairs. Small neighborhoods are essential if we are to have eye-to-eye democracy.

To develop variation and life in every neighborhood we must foster the free expression of the individual and of the group by active effective participation in local affairs.

Wilford M. Aiken, of the Progressive Education Association (*New York Times*, September 7, 1941), has said:

"Participation with others in common concerns is basic in our way of life. Education should lead to constantly widening areas of participation, first in small home and community groups, eventually in affairs of national and worldwide consequence." This, it seems to me, is the sound foundation on which new neighborhoods and new communities should be built.



Acalanes Union High School, Lafayette, California. Franklin & Kump, Associates, architects. One of the best examples of simple, straightforward functional planning of a large rural high school. Students come by bus

Courtesy John L. Reid, Ernest J. Kump Company

FINANCING TAX-SUPPORTED SCHOOL PLANTS IN THE POSTWAR PERIOD

By LEE M. THURSTON

Deputy Superintendent of Public Instruction, State of Michigan, Lansing

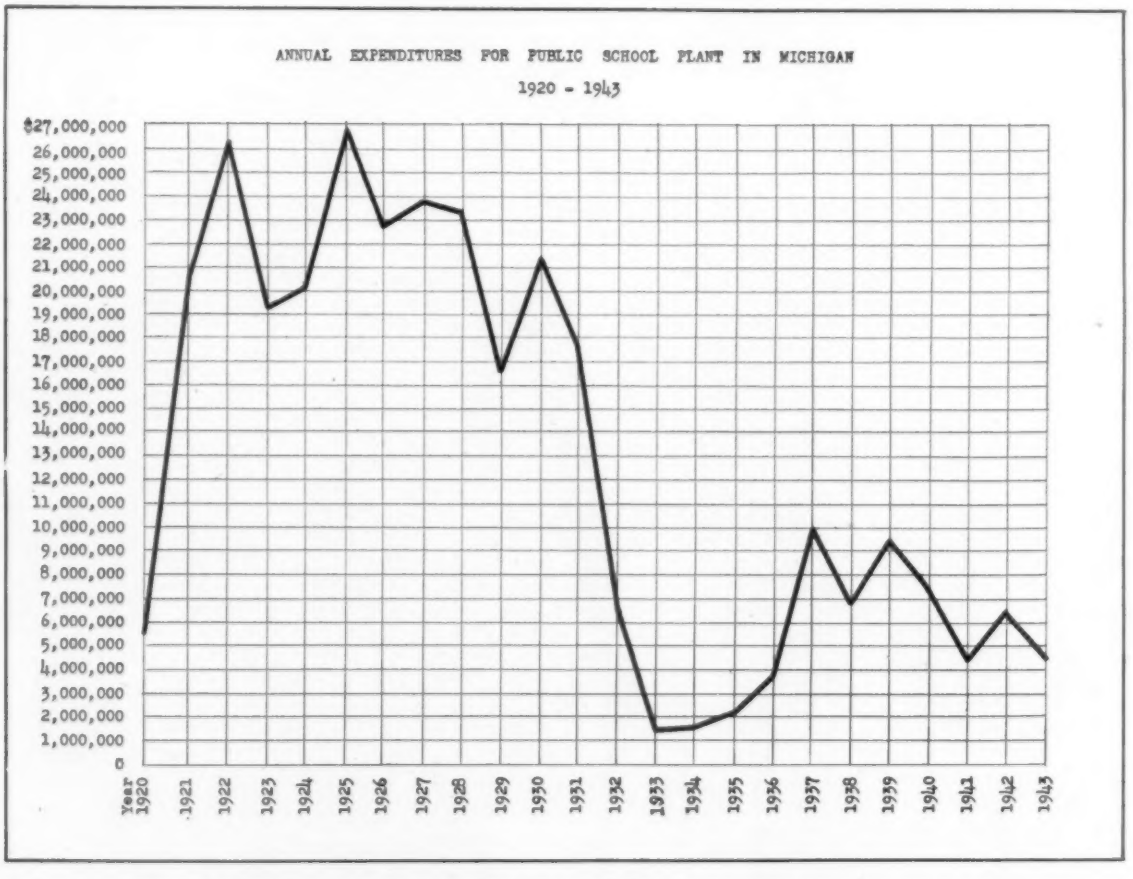
SCHOOL plant construction is due to make long strides after the war. In prewar years, the largest annual outlay for public school plant in the United States was slightly more than $400,000,000. By present indications, expenditures in the postwar period will considerably exceed that sum for five years, probably longer.

Catching Up with Deferred Construction

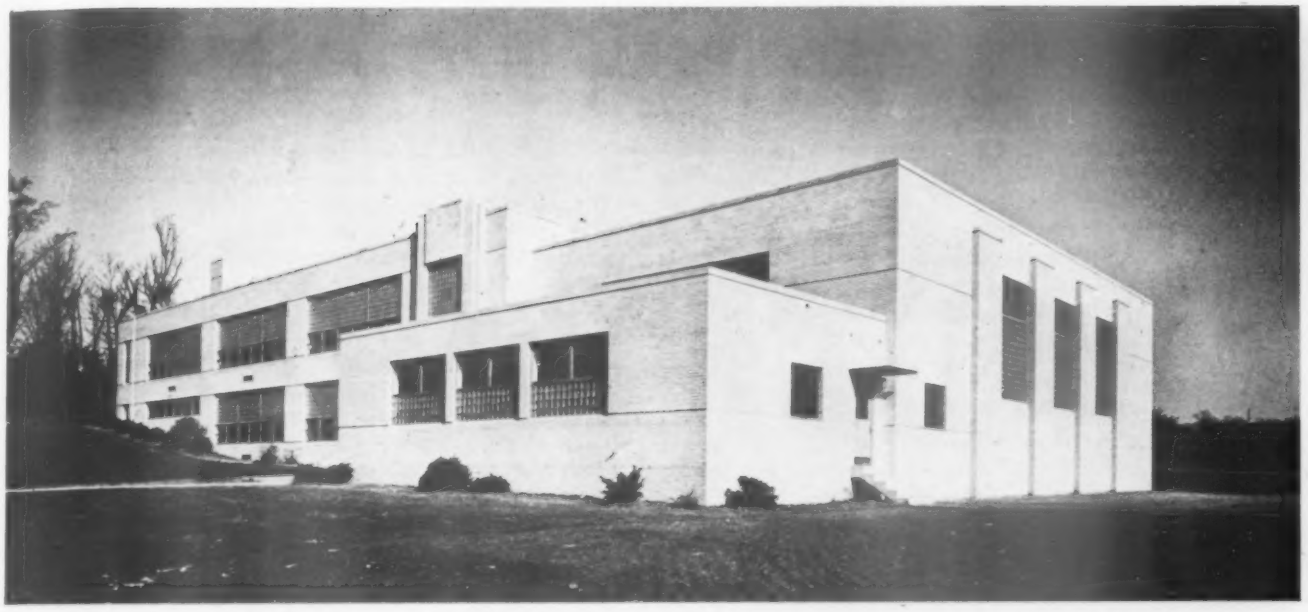
There has been little schoolhouse construction since 1940, mainly because labor and materials have not been available. A few studies have been made of the amount of accumulated backlog of deferred construction. Typical of the more careful studies is one made by the Michigan Public Education Study Commission in 1943. The commission concluded that a total expenditure of $100,000,000 will be required over a five-year period to give Michigan's public school system adequate housing. Several cities have made studies of their own anticipated school building needs. From such state and local studies, we may conclude that from $2,500,000,000 to $3,000,000,000 will be required to achieve a satisfactory public school plant for the nation during the immediate postwar period. The amount of need is of course increasing with each year of additional postponement.

Other estimates, or guesses, have been published, one of them as high as $7,000,000,000, but these higher figures are generally predicated upon the creation of school plants superior to the conventional standards of adequacy or else they presuppose inflation.

It is of course quite possible that an era of higher-



Because of a decline in recent years in expenditures for school plant, there has now accumulated a considerable backlog of deferred construction



". . . to support the creation of truly modern and adequate school plants, the public must be prepared to pay considerably more than $2,500,000,000 . . during the period of restoration and elevation of school plant standards"

cost construction lies before us. As keen an observer as Professor Paul Mort suggests that the public may be ready to re-evaluate the place of education in our national life and may come to think of a schoolhouse as something more than mere shelter for a conventional elementary or secondary school program. Elementary school classrooms may break away from the 22 by 30 foot stereotype. Assuredly the movement to incorporate an adult education program in the public school curriculum is bound to be reflected in departures in public school plant design. The development of the technical institute type of school will require capital outlays, even though a good deal of the expensive equipment needed for such schools may be made available from surplus stocks by the federal government. The interest in secondary and post-secondary education for veterans suggests added plant expenditures, though perhaps largely by colleges and universities.

Health and physical fitness, too, may receive new plant emphasis, as a consequence of the disquieting revelations of the war years with respect to the physical shortcomings of American youth. Physical educational and recreational installations can be expensive in sites as well as buildings. The remarkable success of the service educational programs in the teaching of skills has already underscored the value of educational equipment, so generously supplied to them and used to such good purpose, and so seldom furnished to public schools on a sufficient scale. New construction materials, and new departures in engineering and architectural design, will doubtless manifest themselves in the plans and specifications of postwar school plants, and superior craftsmanship cannot be obtained at standard prices.

If, as Mort intimates, the American people may be inclined to support the creation of truly modern and adequate school plants, the public must be prepared to pay considerably more than $2,500,000,000 for the school building program during the period of restoration and elevation of school plant standards.

The Resources

Resources for financing this anticipated program of school plant construction will not be altogether lacking. There will be some cash on hand to start with, and there will be available credit. The state treasuries now have accumulated reserves aggregating considerably more than a billion dollars. These reserves are still growing and will doubtless continue to grow as long as the general suspension of capital construction continues in effect. True, these state cash reserves are not school funds, but some of the state legislatures are certain to make appropriations from these reserves in support of public school plant construction. A few states have already begun to draw upon their treasuries for appropriations to aid school plant planning.

Nearly all school districts are improving their balance-sheet position, some by the retirement of outstanding debt, and others by laying up building funds for future use. The school district debt in the United States stood, in 1940, at $1,705,000,000. Two years later it had been reduced eight per cent, and today it is probably not much more than $1,350,000,000. The balance-sheet position of the school districts of the United States has never been as good as it is now.

There is reason for believing that future school plants may be financed more extensively from cash on hand and less from borrowing. It is well known that many school budgets are still encumbered with top-heavy interest charges, with a consequent denial of sufficient budget allotments for operating purposes.

Localism Has Been a Mistake

In the past, school plant has been a local proposition. With rare exceptions—Delaware is the most noteworthy—the public school plant has been planned, built, and financed by the local school district. In

many states the state school authority has, to be sure, possessed the power to review plans and specifications, but seldom has it gone beyond the minimum inspectorial duties placed upon it by statute.

Such extreme localism in school plant is not good. It produces extravagance in school building. It leads to the piling up of debts. It confirms, or tends to confirm, the existing territorial organization of school systems, and thus obstructs fundamental improvement. By clogging up a state educational system with inadequate buildings to serve inadequate administrative units, extreme localism interferes with the provision of equal educational opportunity for children and youth, especially the latter.

The Property Tax an Inadequate Source

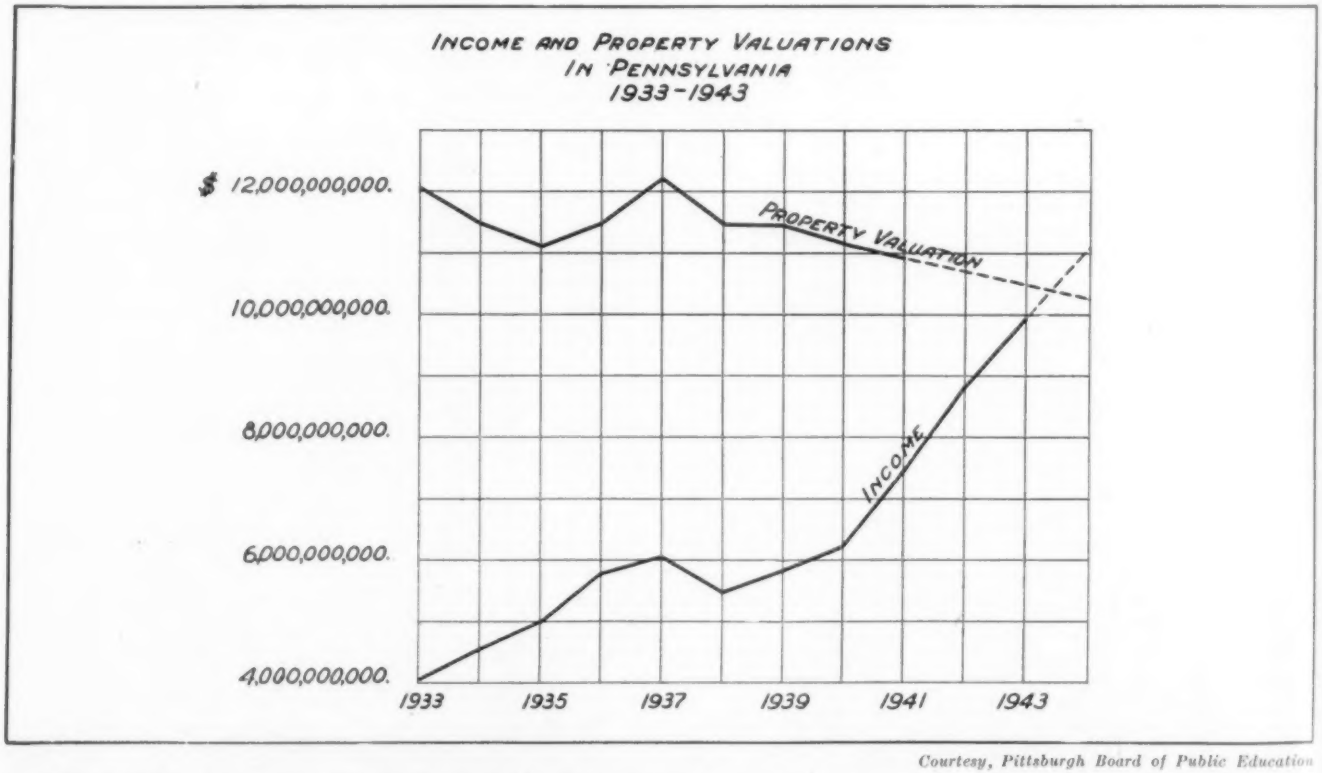
In earlier times the *ad valorem* general property tax, particularly the land tax, was the main source of governmental revenue. But the property tax is unequal to the revenue requirements of the modern state. In recent years, while national income has increased by leaps and bounds, the valuations of property assessed for taxes have in many jurisdictions actually declined. In Boston, for example, the valuation of all property assessed for taxes stood at $1,972,000,000 in 1930, and in 1943 it had declined to $1,446,000,000. And earned income today is vastly greater than the income derived from the ownership of property. In Pennsylvania and in many another industrialized state, current annual income now approaches or exceeds the assessed valuation of all property. Now that the national current income is somewhere near $160,000,000,000, the same thing is true of the nation as a whole. The tendency of the property tax to crumble under the weight of local tax-supported institutions is evidenced in the reduction of tax-rate maximums in several states during the 1930's.

Assessment Practices

Cities vary in their assessment practices. In 1938, New York City was assessed at $16,650,000,000, and Chicago at $2,074,000,000. It is hard to believe that there could have been much similarity in the assessment practices of these two leading American cities. The estimated value of property in the United States in 1938 was $309,000,000,000. In the same year the assessed value of all property in the United States was $141,358,000,000. Plainly, property is not assessed fully or uniformly throughout the nation. The financing of school plant, which more than any other educational expense rests upon the property tax, should be given a basis of support that is broader, and that is not cramped by unevenness of application and by all the limitations, legal, political, and economic, that surround the property tax.

The problem of improving the rural school plant is more difficult to solve than that of the urban school plant. The main trouble here is finance. What property the farmer owns is more likely to be assessed for taxes than what the city dweller owns, and the property tax in rural areas is therefore nearer to its elastic limit than it is in the cities. There is not likely to be much improvement of rural school plant under the prevailing scheme of paying for it out of the proceeds of local property tax levies.

There has already been a general shift of operational school support from the property tax in the direction of state support, based on a balanced tax



Courtesy, Pittsburgh Board of Public Education

"In Pennsylvania and in many another industrialized state, current annual income now approaches or exceeds the assessed value of all property"

program. A similar shift in school plant financing is long overdue.

Statism Is Not the Answer

This does not mean that the state government should take over the planning, financing, and construction of community school plants. To do so would be to substitute for the evils of complete localism, another set of evils equally bad and perhaps worse. The state educational staff, remote as it must be from the scene of action, cannot solve single-handedly the community educational problems. But it can help. What is needed is joint action between community and state with respect to planning, financing, and constructing.

It seems reasonable to expect the average local school community to provide 50 per cent of the cost. The interest of the state suggests that it should likewise provide half of the cost. Inasmuch as communities vary in their economic abilities, a system of equalized school plant subsidies ought to be used. Under such a system the communities of lesser wealth per pupil should receive a larger amount of state aid for buildings than communities of greater means.

In addition to furnishing money, the state should participate in the planning of buildings. The main reason for such state participation is to be found in the fact that school plant can not be dissociated from school district organization, and the state must make it possible for local communities to have good organization. It is sound policy, also, to involve the state school authority in a review of plans and specifications. The state has an inescapable interest in safety and sanitation, and in the provision of schoolhousing units in which education can be carried on efficiently.

Federal Aid for School Plant

As this is written (November, 1944) the Congress has not indicated its fiscal intentions with respect to postwar non-federal public works. Doubtless there will be a public works program. Whenever, in the past, the private industry of the United States has enjoyed a period of rapid expansion, there has been at the same time an expansion of public investment. Examples are the land grants to the railroads in the 1850's, the school and highway development of the 1920's, and the government war plants of the 1940's. Postwar expansion of American industry is reasonably assured, and as has happened so often in the past history of the United States, this expansion of private enterprise will be associated with large public investment. Public works enterprises of considerable volume, financed largely from state and federal funds, now appear highly probable.

If present expectations of substantial aid from the federal government for public school plant are realized, it is to be hoped that certain historic mistakes will not be repeated. Federal aid for school buildings can do harm as well as good. School plant grants-in-aid, whether from a state or from the federal government, ought to be given only after basic surveys of need have been made. If a state gives building aids indiscriminately to all and sundry who ask for it, the effect is likely to be a freezing of an unsatisfactory school administrative organization, and consequently a permanent denial of adequate school opportunity.

"There is not likely to be much improvement of the rural school plant under the prevailing scheme of paying for it out of the proceeds of local property tax levies"

Building aid is the most effective means at the command of the state for advancing voluntary reorganization. Federal aid for public school plant should, therefore, under no circumstances bypass the responsible state.

Reorganization and School Plant Are Related

A program of building improvement, undertaken with the best of intentions, is likely to create demands for retaining inadequate administrative units. It follows, therefore, that every state school authority should carry forward scientific studies of public school plant need as part of its program of continuous improvement of basic organization.

Higher Education

The tax-supported institutions of higher education present a somewhat different problem. No one knows exactly how much their enrollments will increase during and after demobilization, but no one doubts that our colleges and universities will be swamped with students. To expand and renovate their plant will be an expensive undertaking.

There is first the problem of enlargement to accommodate the anticipated influx of students and increased staff. Second, there is the equally important problem of modifying the buildings and equipment to reflect the immense gains made during recent years in science, art, and craftsmanship, and to provide auxiliary services. To be sure, some of the future college plant investment, such as that going into dormitories, may be self-liquidating, and as such will not be a drain upon tax revenues. But most of the improvements in college plant will be reflected in increased institutional budgets, and in the case of the tax-supported colleges and universities, these increases will come mainly from tax revenues or from borrowings that will encumber later tax revenues.

Private benefactions, once an important source of money for college plant construction, have in recent years been less bountiful, and there is no good reason for thinking that large donations will again figure as importantly as in bygone days.

PLANNING SCHOOL GROUNDS TO SERVE THE ENTIRE COMMUNITY

By ORIN B. GRAFF

Superintendent of Education, Norris School, Norris, Tennessee

THE title of this article suggests a bias on the part of the author in favor of the community school. Such is the case. This is fair warning to the reader, but he deserves more. The community school concept as it is commonly used is so nebulous that some clarification of it is needed before entering into a discussion of school ground planning to serve the entire community.

School Becomes Directive Force

Historically, the school developed largely as a supplementary community agency where youth were taught certain academic skills and moral precepts that could not be efficiently acquired in normal life activities. Gradually the public shifted other responsibilities to the school: vocational education, adult education, citizenship education, health education and recreation, and a host of others. The first statement, generally accepted by the teaching professions, that recognized these public demands is the well-known "Cardinal Principles" published in 1918.

The official sanction provided by the "Cardinal Principles" opened the leaking flood-gates and hundreds of new courses flowed in turbulent fashion into the school curriculum. The "Principles" themselves, while enlarging the scope of the curriculum, offered no real sense of direction for public education. In fact, they affirmed the school's responsibility for the "fundamental processes" and acknowledged educational needs in general areas of living reflected in statements on "vocational efficiency," "worthy home membership," "citizenship," and "worthy use of leisure time."

The flood continues; in fact, it has been accelerated by the crisis of war, nor is it safe to assume that the flood will stop. There is plenty of evidence that the tempo of the times will not lessen; that rapid change will continue to create new demands on schools and other community agencies as well.

For giving direction to this inevitable change, democracy pins its hopes on the cooperative use of intelligence on a community-wide basis. Major institutions and agencies are organized on a coordinate basis to share in the solution of community problems. A supplementary agency dedicated to the task of teaching the "three R's" is anachronistic in this modern setting. Education is raised to a high level. The so-called "fundamentals" remain, but there is a superior function: the school is charged with eternally safeguarding the growth and development of the cooperative use of intelligence in all aspects of community life—for young and old alike. A school serving this function can be called truly a community school.

It must be admitted that many communities are not effectively organized to meet their own needs. In such cases, the most vital agency must deal with crucial problems regardless of the fact that doing so may seriously detract from service to their proper functions. Schools are frequently forced to destroy their effectiveness through serving functions other than that of education. The school should cast off extraneous jobs and develop a continuing program of education for all the people it serves. Thus a school can become the central agency and directive force for organized public educational effort in a community.

Community Resources

Allocation of Administrative Control

So far as the school is concerned, the problem is that of free access to needed resources without being burdened with the administration of community facilities used, in greater part, for purposes other than education. A program of forestry conservation, for example, is essential in a modern rural community, but the responsibility for such a program may not properly be shouldered on the school. The school does have some real obligations in this kind of project: one is to educate both youth and adults in the contributions of forestry conservation to the general welfare. To do this job well, the school should have access to the forests as a laboratory for instruction. Control over the project is not essential; a cooperative relationship with the administration in charge of the project is all that is needed to insure effective educational procedures.

From the foregoing discussion, the conclusion may be reached that the school needs administrative control over only those grounds or "laboratories" that will be used principally for educational purposes. This principle will not be of much help unless the school has at least a fair understanding of the resources at its command in relation to its total program. Assuming that the prior step of clearly defining the general aspects of the program has been taken, the school has the responsibility for initiating a comprehensive survey of actual and potential community educational resources. Once these are defined, objective consideration can be given to two coordinate and interrelated problems: (1) the arrangements that can be made for the part-time special use of "grounds" controlled by other community agencies; and (2) the "grounds" that are needed to the extent that the school should have complete administrative control over them.

Laboratories Outside the School

A school dedicated to a community program of education needs a lot of space and equipment for opera-

tion. Much planning and research has been carried on in the interests of improved housing for schools. In comparison, the time and attention given to needs of space outside the buildings has been scant indeed.

This inadequate planning of school grounds is a serious fault. Not all classes or activities are best conducted within the walls of a building. Field trips, for example, are recognized as indispensable in the teaching of biology. The time and place of a school activity cannot be specifically determined by some expert outside a particular school situation. Rather, time and place should be an internal function directed by the understanding that an activity should be conducted when and where it can be most effectively organized to highlight the principles of the project under consideration. If this suggestion is valid, then playgrounds, factories, farms, market-places, gardens, homes, forests, streams, courts and other public agencies will all, at times, be laboratories for the school.

Need Basis for Sharing

It is at once evident that a considerable share of the out-of-school community laboratories need not and should not be owned or controlled by the school. To take an opposite stand would be to suggest that the school should have an administrative control of the entire community; a conclusion which could be justified only on the assumption that education is the prime function of community life. If, however, education is coordinate with other major community functions, the school is entitled to share resources on the basis of need. Allocations of administrative control becomes a practical matter to guarantee availability for use or, on the part of the community, to fix responsibility for stewardship.

School Grounds

What Are Other Available Resources

Previous mention has been made of the administrative arrangements necessary between the school and other institutions to give the program access to laboratories for instruction. In fact, the answer to the problem of what school grounds are needed is dependent, in large measure, upon the availability of types of resources not controlled by the school. For example, parks and gardens may not be needed if forests and farms are readily accessible. Too, it is better practice to utilize existing resources, provided

Courtesy of Durham (N. C.) Recreation Dept.

"Not all classes or activities are best conducted within the walls of a building"

they are equal or superior to those that may be created. The economy angle is obvious. More important by far is the fact that this procedure, through bringing the school in constant contact with the life-stream of the community, tends to tear down the "walls" and to keep the curriculum vitally responsive to community needs.

Community Use

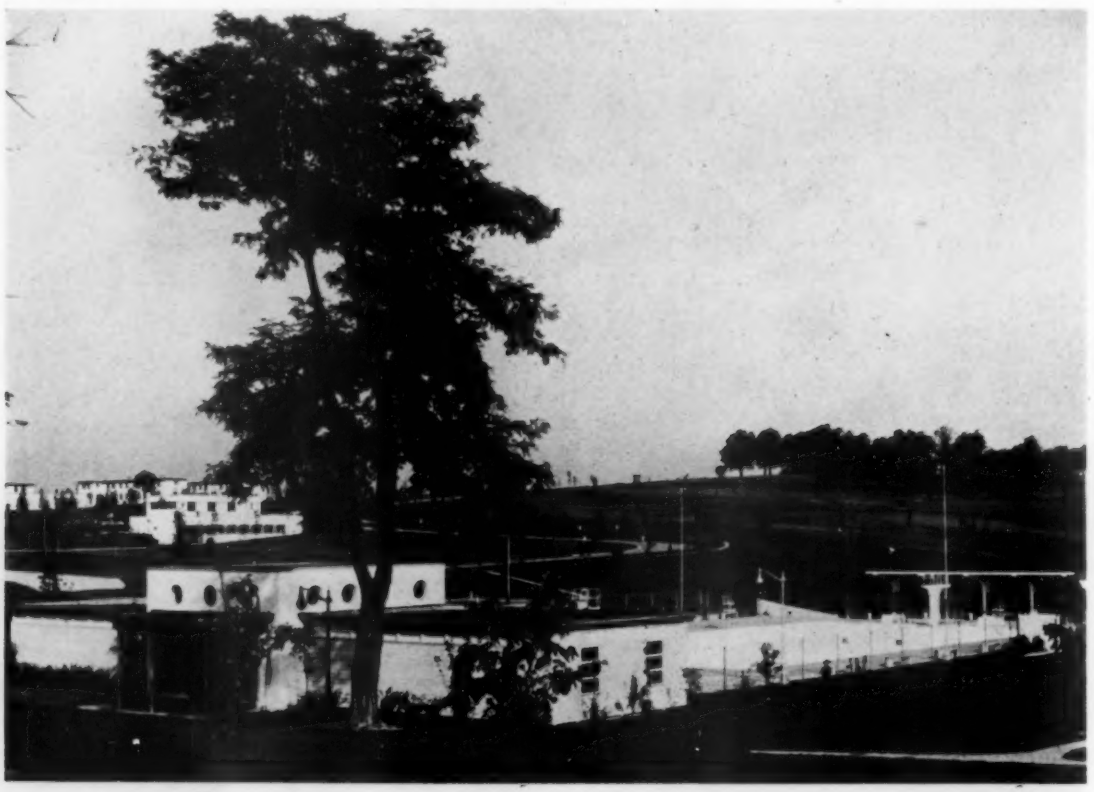
Although much has been made of the desirability of the school using the facilities of other community agencies, up to this point the discussion may have seemed to carry the assumption that certain of the school grounds will be used only by the school. This is not necessarily true. Obviously, it is as unwise to refuse the use of school grounds as it is for another public agency to deny the school needed access to the facilities it controls. The grounds are under the administrative control of the school because they are used primarily for educational purposes. However, efficient use of community resources cannot be assured unless the grounds may be used to serve other worthy community projects when not needed by the school. Any other point of view is likely to lead to duplication of facilities and blocking of cooperative relationships; effects which will, in the long run, place the school in a community compartment and emasculate the objective of promoting education on a community-wide basis.

Social Objectives Come First

Actually, what grounds shall be developed and controlled by the school? Clearly, this question can be fully answered only in terms of the requirements of a particular school situation. A stadium is unimportant when few care to watch organized game play. An outdoor pool is not needed when a swimming beach is nearby. On the other hand, a rural community will find it impracticable to maintain a factory for the express purpose of providing a school laboratory situation. Or a city may find it totally impossible to make streams, farms, and forests accessible for the same purpose.

There are, however, common elements in the majority of situations that make it possible to lay hold on certain general problems. Playgrounds may serve for an example. The gridiron and baseball diamond are typical adjuncts of the large American high school. Not infrequently, these playgrounds tend to become places where a few skilled players entertain the community, usually for a price. Activities of this nature may bear the same relationship to a good program of health, recreation, and physical education that dessert does to a Sunday dinner, but it should be remembered that dessert is a poor substitute for a well-balanced meal.

Recreation involving physical activity has important contributions for body growth, physical health, and mental health. It can also be organized and directed to develop the social habits and ideals of the participants. So desirable are these objectives that a community may well consider its recreation program largely in terms of their achievement. It is true that a number of forward-looking schools have, in recent years, expanded their playgrounds to meet the requirements of a good program of recreation or physical education. In most instances, these facilities are closed or unsupervised during the summer months. This is but one illustration of how our unfortunate tradition of a part-year school program becomes a



View of the swimming pool, the Greenhills (Ohio) school - community center

Photo by Carl P. Goetz

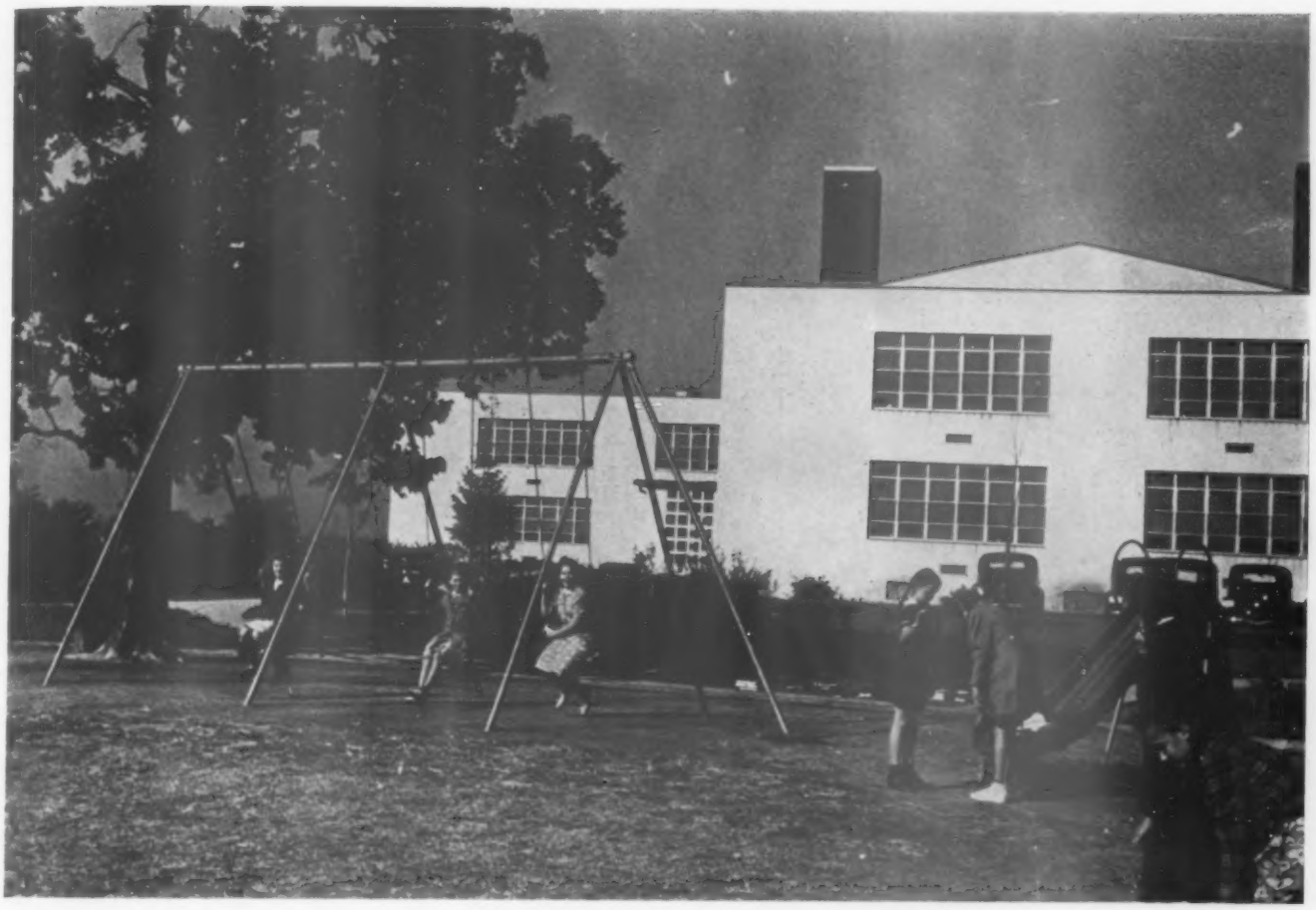


Photo by John Vachon

The playground for children at Greenhills is adjacent to the school

great practical obstacle that blocks the path of educational progress.

Parks and Playgrounds Are School Function

Parks and playgrounds have been developed in most communities quite apart from the schools. There is small reason why this development, especially with regard to playgrounds, should not have been under the control of the school, except that the school's intermittent program would deny to the public the use of these facilities during the period of the year when they are most needed. A school, operating on a twelve months' basis, might control all public playgrounds with the maximum profit accruing to the entire community. These facilities should be located to service adequately all centers of population. The schools should have charge of general administration, planning and supervision of activities organized primarily for educational purposes, and general supervision over other community uses of the grounds.

Playground equipment ought to be selected in terms of its usefulness in stimulating participation on the part of all age groups. While some permanent structures will necessarily be installed, it is essential that the equipment for large areas be arranged to permit adjustment for a variety of activities. In the construction of the permanent structures, this principle of flexibility can be used to great advantage. For example, a stadium can be planned to accommodate not only football and baseball games, but also plays, pageants, festivals, field days, and a great variety of of lesser sports events.

Special playground areas should be equipped to meet the needs of younger children. Swings, sandboxes, climbing apparatus, slides, teeter-totters, wading pools, and space for organized game play are examples of the equipment required for these areas. With a little ingenuity, most of the equipment needed can be built in the school shops at a minimum cost. Local construction has the additional advantages of stimulating study of and adaptation to factors peculiar to the situation. Storage space is, of course, needed for small items of equipment. Adequate shelters, toilet facilities, and sanitary provisions for drinking water are common necessities for all playgrounds.

Principles Derive from Community Concept

This article turned out to be a discussion of principles governing the planning of school grounds to serve the entire community, with perhaps too little attention given to illustration or to existing scientific studies of space and equipment features of specific activities. It seemed best to first get the principles out in the open—limitations of space prevented a lengthy treatment of the latter two. Attention is again called to the fact that the principles discussed get their meaning largely from the concept of the community school.

Hedrich-Blessing photo

PLANNING AN OVERALL LONGTIME CAMPUS PROGRAM

By ERNEST L. STOUFFER

University Architect, University of Illinois, Urbana

CAMPUS planning is a most fascinating task—always changing, never finished. For it is a part of the vigorous, ambitious young life that is the raison d'être of all our American young, fast-growing great colleges and universities.

Colleges Have Similar Physical Problems

Our campus at Illinois came of good ancestry; some of the keenest of American planners—C. H. Blackall, Frederick Law Olmsted, D. H. Burnham, Charles A. Platt, Ferruccio Vitale, James M. White, and others have added to its stature while it was in their care.

Our campus plan was fortunate in the environment in which it developed—the broad, rich, prairie acres of a large, populous, wealthy state whose citizens have deep-seated convictions as to the value of higher education. Moreover, its semi-rural setting has at all times permitted ample elbow and leg room denied many another great university, particularly the older, Eastern universities in urban settings.

I realize that many campuses are not so fortunately endowed, yet, I have learned that the physical problems of higher educational systems are surprisingly similar whether the location is Maine or California, Florida or Washington, or somewhere in between.

There are a few rare cases in which a complete university or college has been built "from scratch" on new ground. This is true of Duke University and the University of Rochester. Raised in such ideal situations, it would have been surprising if these campuses had not turned out well. Most of us, however, have had the stepchildren of others entrusted to our care.

Consider History of Growth

Our first task is to get thoroughly acquainted with our particular "ward." We must delve deeply into its

Page facing:

Illinois Union Building—Note simple broad sweep of lawn, with informal planting at the building quite in keeping with the Early American style of architecture in the background

past history—the situations which gave it birth, the career to which it was dedicated, its various institutional aims and interests, local habits, customs, and its particular eccentricities.

Generally, we find that we are dealing with a healthy individual—one who has grown sound of body and limb. Yet, we may not live long with our campus before we come to the conclusion that an operation—sometimes major, more often minor—would be helpful in attaining greater physical usefulness. Most often we find where trained guidance has in the past been lacking that the greatest deficiency has been that of forward thinking. The ensuing construction now makes it difficult to suggest development and expansion in the direction most obviously needed.

We must consider the growth limitations of our campus. The finest of plans is worthless if it is impossible of attainment. Limitations are frequently physical; the campus is bound in by expensive improvements on adjoining private property, or perhaps by a broad river. Limitations may be financial; perhaps the institution cannot by any stretch of the imagination be expected to produce the funds necessary for the ideal development. Again, limitations may be those of a charter, or an agreement with a neighboring institution. Or the school may be limited as to curriculum.

Living conditions may greatly affect the campus plan. Dormitories and provisions for extracurricular activities are needed much less by an institution in a great city than they are by a college in a rural community.

Interrelationships Are Important

Now, let's focus our attention more sharply. Let's consider internal relationships. Nothing is more important than the interrelationship of the various schools and colleges on the campus. Home economics, for example, has little in common with engineering but is much interested in liberal arts, music, and the college of education. Liberal arts quite commonly functions largely as a service school to other colleges and as such may well be located near the geographical center of the campus. The library should be literally as well as figuratively the "heart" of the educational institution.

Minimum passing time between classes is all-important, and often a serious problem for the larger institutions. Thus, all extracurricular activities such as athletics, play areas, administration buildings and grounds facilities, dormitories, etc., are properly crowded more or less to the perimeter of the academic campus.

It goes without saying that home economics and women's athletics are best located adjacent to the areas where the women largely reside. Similar reasoning applies throughout the campus study.

Particularly in the large city, the location of the principal transportation system vitally affects the campus organization. As is true with department stores, the function catering to the greater masses should be located nearest the entrance. Boys will travel farther afield than girls. The campus business district exerts a similar influence.

Emphasis Must Receive Consideration

Thought must be given to the elements that are assembled to make up the various colleges within the university. Few colleges exhibit exactly the same pattern, frequently following the strength of leadership or the lack of it. Physiology, for example, may be taught by liberal arts, by medicine, agriculture or veterinary medicine, or in two or more such colleges. Thus, a proper location for a particular college on one campus would be improper on another.

Every school has one or more fields in which it has achieved particular eminence. For one, it is journalism; for another chemistry; for still another engi-

Architectural Building—The need for large well-lighted rooms for drawing and art classes dictated this building design. A beautiful wrought-iron and masonry gateway unites this building with the Commerce Building. A companion gateway stands ready to join a future building on the left

Commerce Building—One of the south quadrangle buildings designed by Charles A. Platt. Note the formal hedge with pedestal and urn accents. When dwarf crab apple trees between hedge and building are fully developed, the planting will form a beautiful complement to a well-proportioned building

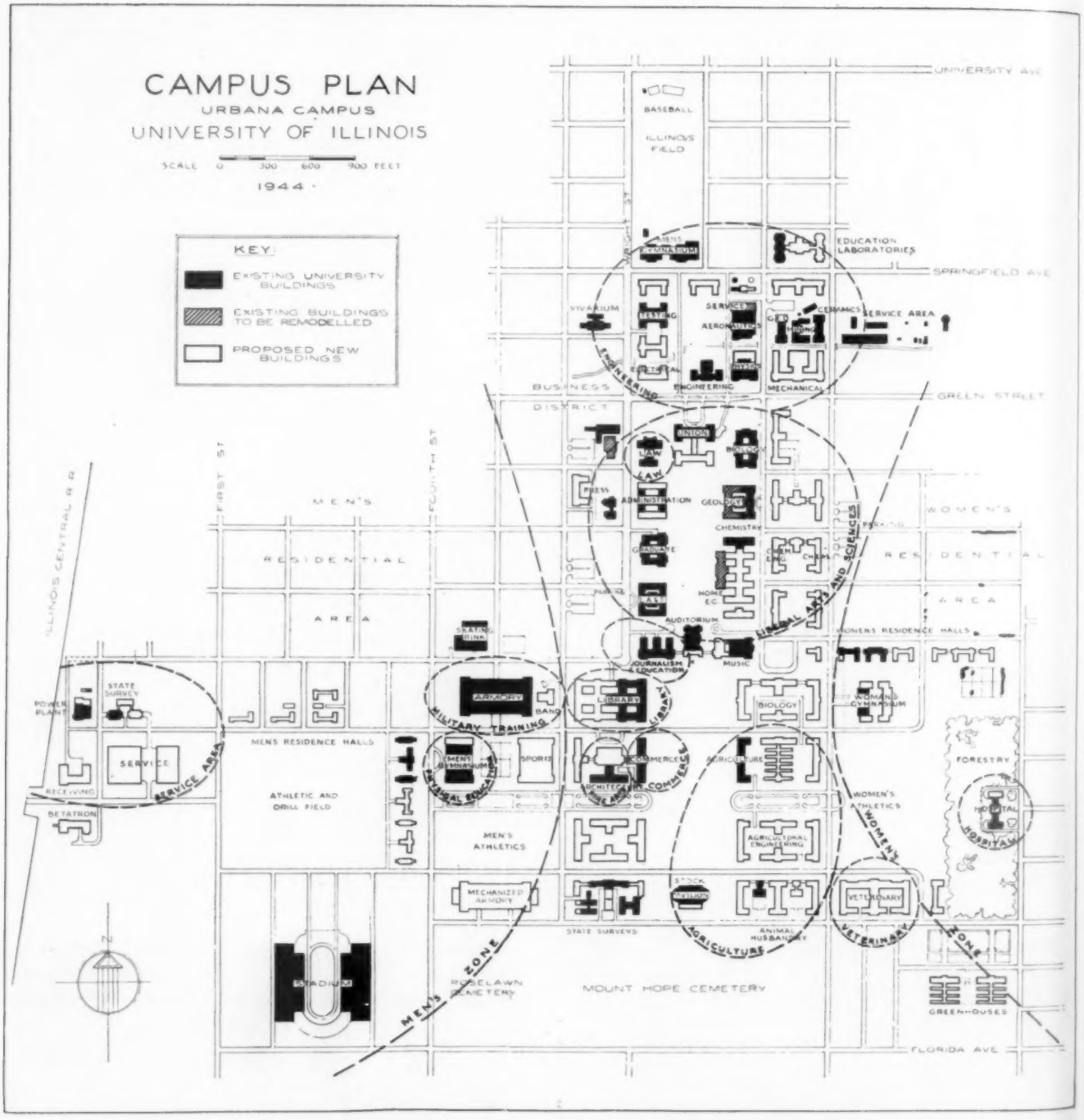


Fig. 1.—Current campus plan for future development of the Urbana campus of the University of Illinois. Building indication is by function rather than by official name

neering. Obviously, that field of greater achievement will require greater consideration in facilities.

Future Development Requires Checking

The one great problem that overshadows all others concerns the correct appraisement of future growth and development. If this is set at too low a level, the institution at some later date may find itself in serious difficulties, if not physically throttled. If the appraisal is too visionary, the campus becomes scattered, disjointed, and wasteful, not only financially but in terms of effort.

Our study must be practical and thorough; the final organization must be logical, cohesive, and artistic. Such questions as massing of buildings, settings, traffic circulation (both vehicular and pedestrian), styles of architecture, vistas, and campus planting belong to the specialists in those fields. Such problems seldom are satisfactorily solved by those without special training and experience.

Thought must be given to the probable sequence of development that should be followed for orderly campus growth.

Undoubtedly, thought will be given to several al-

ternative schemes of development before one is finally selected.

Theories should be checked with alert men of the staff, particularly leaders on the administrative staff who are in the habit of thinking in broad terms. Very probably you will work with a committee. This is most excellent; many minds are better than one.

One difficult problem is the decision as to which buildings justify "face lifting" (remodeling) and which must feel the surgeon's scalpel, and be removed. If more attention were given to systematic modernization and eradication of obsolescence, fewer buildings would be removed. All too often a building is torn down not so much because it stands in the path of progress as because everyone has come to the conclusion that it is just "impossible." Remember that in a university it takes generations to create in the new building the traditions and reverence that enshrine the old.

Campus Plan in Action

Once it is formed, don't wait for some great movement to initiate *your* campus plan. See that all physical developments follow the plan. It well may be initiated with a short length of sidewalk, a planting of a few trees, or the building of a new road.

I would like to re-emphasize the thought that we are dealing with a living, growing entity. That which is proper today will be unsuitable tomorrow. A campus plan that best represents present thinking will normally need revision in a few years. Education will have changed its emphasis or procedure. Some individual will have achieved distinction in a particular field, and therefore, emphasized that field for the institution. A new president will have new aims and objects. The demands of industry for trained personnel will have changed. These and many other factors are constantly at work to change the best of campus plans. I have seldom, in fact, seen a new building actually located in the exact spot marked for it on the advance campus plan.

Campus Relationships at the University of Illinois

Finally, as an example, I want to point out on our own campus plan (Fig. 1) some of the relationships and developments that have been discussed in principle—not that the campus plan of the University of Illinois is any better than that of any other university, but because familiarity with it makes it easier for me to cite these logical relationships. The same analysis may readily be applied to almost any other college or university campus.

The University of Illinois has always been plan conscious, from the first campus plan prepared in 1871 (four years after the institution was founded), to the latest illustrated in Fig. 1. In fact, a very interesting and well prepared 245-page book * has been published on the history of the campus plan of this university down through the years, with illustrations of some twenty plans prepared by the distinguished architects and landscape architects noted earlier in this article.

In examining Fig. 1, the following should be noted:

1. Grouping of schools and colleges as a whole in

* *History of the Growth and Development of the Campus of the University of Illinois*, by Tilton and O'Donnell, published by the University of Illinois Press in 1930.

The lily pond at a corner of the campus attracts many visitors in season

one closely knit assembly—the larger colleges as group units, the smaller schools and colleges located somewhat through circumstance, yet with logic.

2. The L. A. & S. College, the great service college to all the others, is the center of the academic campus.

3. The library, the "heart to any educational institution," located near the center of university life. Note that this building has been designed on a "unit scheme." Five additions have been built since the initial construction in 1925, to house ultimately 5,000,000 volumes. Two stack additions to date have increased this capacity from an original 1,000,000 to 2,000,000.

4. The housing, largely private, for 14,000 students immediately adjacent to the academic campus. Over the years about two-thirds of the men have lived west of the university (in Champaign) and about two-thirds of the women east of the university (in Urbana).

5. The location of non-academic activities on the campus perimeter, service buildings, press building, athletics, military training (compulsory for two years for men), skating rink, athletic fields, dormitories, hospital, etc.

6. The location of agricultural and veterinarian colleges next to each other because of allied interests. Note also that they are on the south edge of the academic campus near to the 2,000 acres of university farms on the south to which their interests are closely related.

7. Location of through streets and roads, the use of interrupted streets to discourage their use by non-university traffic, and to encourage only local traffic adjacent to buildings.

8. Location of the stadium—not too far from the main railroad, and where open areas will provide parking space for the thousands of automobiles that must be cared for in connection with an activity that may attract 70,000 visitors to an event.

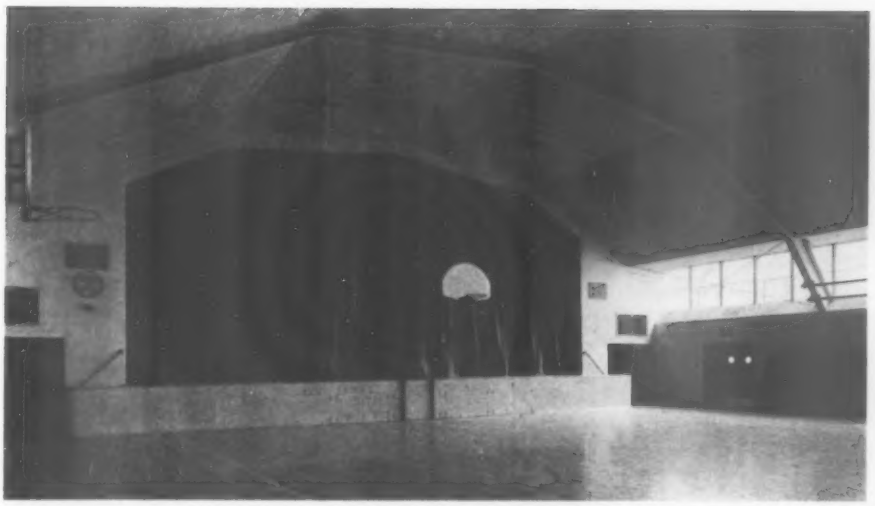
9. Breaking up of campus into large quadrangles, the judicious use of narrow streets and wide malls to lend interest. Photographs of the Illini union, commerce, and architecture buildings illustrate use of tree planting, formal hedges, foundation, and other treatment to embellish and enhance the building units. Note also the close harmony in style and treatment in the new campus buildings shown.

10. Location of union and administration buildings adjacent to campus business district and main cross inter-city street, where they can serve as "front doors" for the institution.

Campus Planning, a Challenge to All

Campus planning should not be considered a question for specialists only. There is no reason why anyone should not wrestle with his own campus plan problems, with ample satisfaction to himself and resulting profit to his institution. As with a game of chess, one may occasionally forecast the wrong move; but, oh, the thrill when after one has been arguing a particular program for years, the opposition comes around and says, "you are right."

Rock garden southwest of Women's Gymnasium forms a small retreat within the main campus



Esther Born photo, courtesy Architectural Record

PLANNING PARTICULAR FACILITIES

The war period has accentuated the discovery and development of new products and the adaptation of old ones for new purposes. True, they have been restricted to war uses. Soon, however, they will be available for peacetime applications. Those planning new school and college buildings will want to have information about new products and processes and will welcome guidance in their uses in the school and college plants of the future. We are pleased, therefore, to present in the pages which follow the findings and conclusions of several who have made studies in these areas.

PROBLEMS IN DESIGN AND OPERATION CAUSED BY MULTIPLE USE OF THE SCHOOL PLANT

By DON L. ESSEX

Director, School Buildings and Grounds Division, N. Y. State Department of Education, Albany, N. Y.

IT is the intention in this article to discuss a limited number of problems in design and operation caused by multiple use of the school plant. Special attention will be given to community use of the plant. By no means are all problems covered.

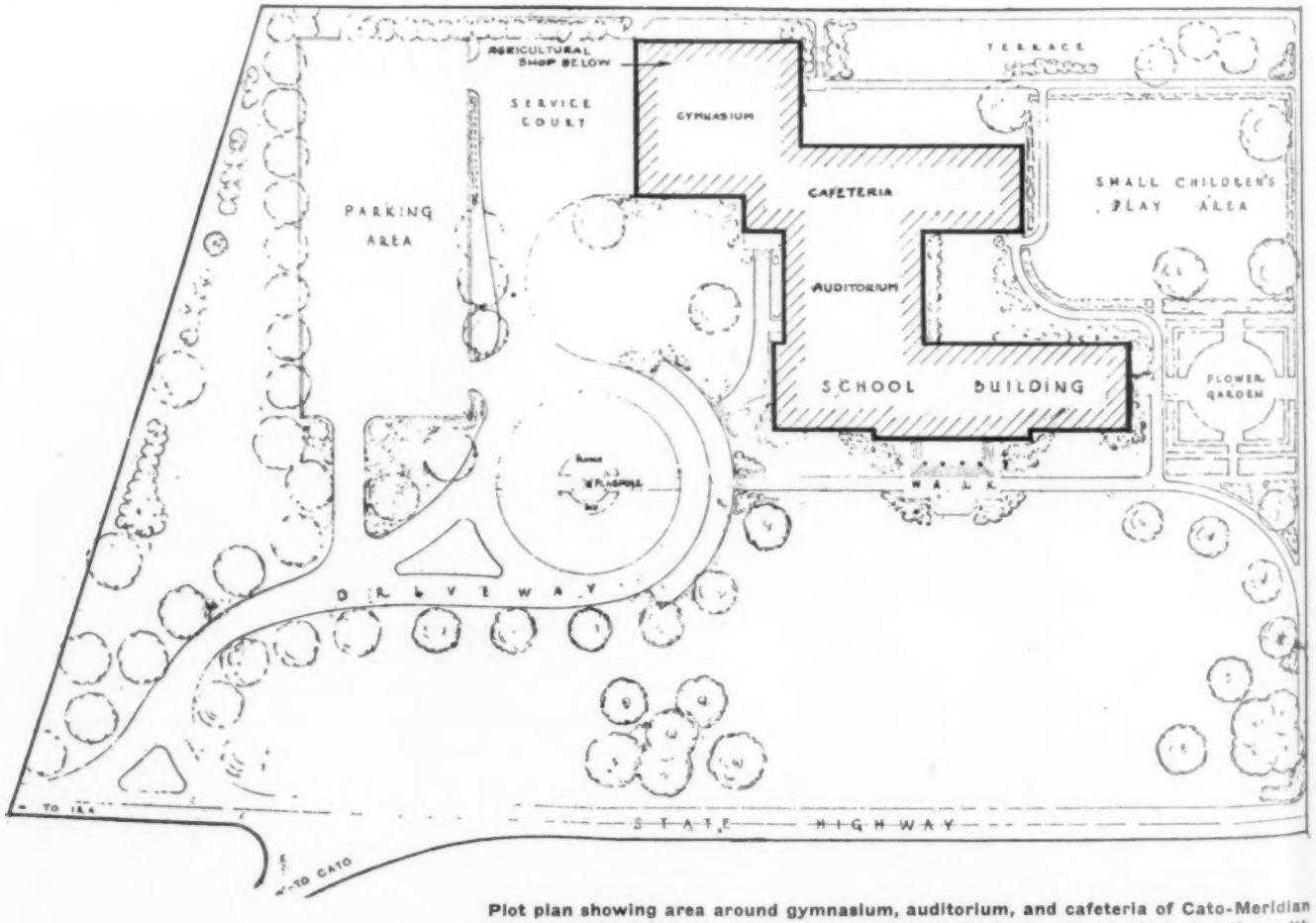
Primary reference in this article is to schools in rural communities where one building houses the entire school having a school population range of from 500 to 1000 pupils and two-thirds of its pupils living in the country. In communities of this size and character, the school plant should be planned and equipped to provide for all the educational, recreational, and cultural needs of the entire community. To do otherwise means the duplication not only of costly building facilities but also of costly items of operation and maintenance.

The following problems will be discussed:

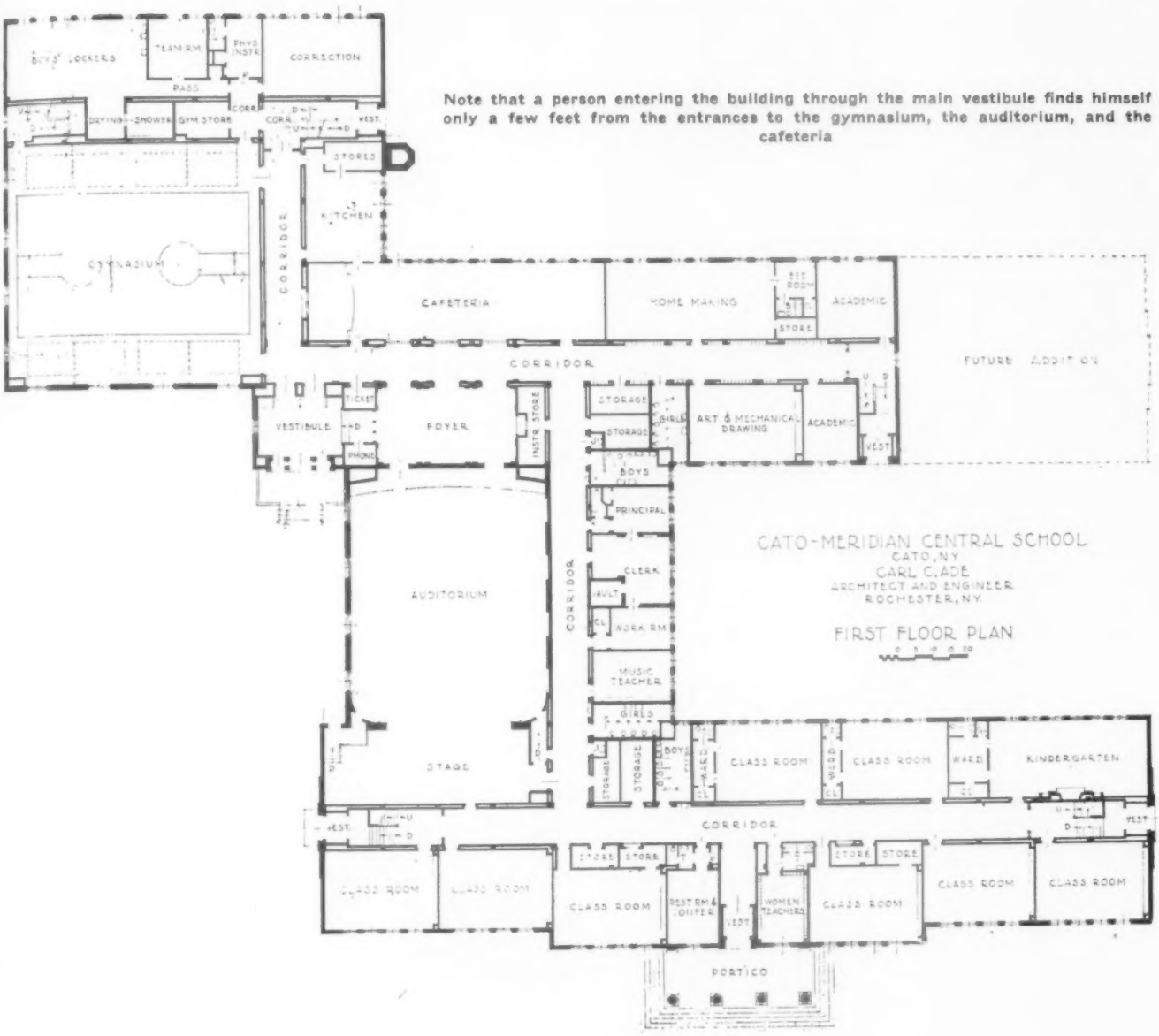
1. Location of facilities used by the community
2. Heating
3. Storage space for equipment
4. Toilet facilities
5. Custodial service

Locate Community Rooms Conveniently

So far as is practicable the facilities used by the community should be located so that (a) they can be readily reached from the drives and parking areas (most of the people will drive to the building) and



Plot plan showing area around gymnasium, auditorium, and cafeteria of Cato-Meridian (N. Y.) Central School. Carl C. Ade, architect, Rochester, N. Y. Note location with reference to main public entrance, drives, and parking area. See detailed drawing of Cato-Meridian School page facing



Note that a person entering the building through the main vestibule finds himself only a few feet from the entrances to the gymnasium, the auditorium, and the cafeteria

(b) they can readily be reached once the main vestibule is entered.

The Cato-Meridian (N. Y.) Central School Building is a splendid example of the application of these two principles. Note in the accompanying illustrations that the drive swings near the main public entrance and the parking area is nearby. Note also, that the main public vestibule is within a few feet of the entrances to the gymnasium, the auditorium, and the cafeteria. The agricultural shop and the school bus garage are located beneath the gymnasium. (With the terrain falling away sharply these facilities are entirely out of ground.)

Maintain Dual Heating Controls

The heating system should, as a measure of economy, be so designed that the rooms used for community purposes can be provided with heat adequate for occupancy while at the same time the rest of the building is maintained at a lower temperature. In the Cato-Meridian building, the gymnasium and auditorium are reached by separate valved steam mains. Furthermore, in every room in the building, thermostatic control is so arranged that either day or night temperatures can be secured. It is also possible, by pressing a button on the face of the thermostat, to reset any thermostat for daytime temperature while the balance of the thermostats remain set at night temperature. Thus the agriculture shop, the office, the health clinic, the homemaking room, etc., can each be heated adequately for occupancy while the rest of the building remains at night temperature.

Provide Suitable and Adequate Storage Space

One of the key principles in planning a room for multiple use is that suitable and adequate storage space for the equipment essential for the various activities should be provided. Indeed, in many buildings of recent construction that have come under the writer's observation, about all that is needed to make

Courtesy of National Recreation Association

Equipped with a stage and provided with necessary storage facilities, the cafeteria is suitable for play production

them satisfactory for multiple use is to provide necessary storage space.

In the Cafeteria

For example, the school cafeteria dining room can be a most useful general purpose room, if properly planned and equipped and if provided with suitable and adequate storage space. During the school day it can be used for dramatics, oral English, visual and radio education, and assembly of small groups. After regular school hours the room becomes invaluable for small assemblies of groups such as parent-teacher associations, farm organizations, and boy scouts, and for dances and other recreational and social affairs.

Usually the cafeteria dining room in a school of the size and character under consideration contains between 1,000 and 2,000 square feet of floor space. To be usable for multiple purposes, the cafeteria dining room should be completely separated from the kitchen and serving counter by a partition of permanent construction, should contain a small platform or stage at one end, should have thorough acoustical treatment, should be attractively decorated, and should contain a motion picture screen, and blackboard and display board space. Of equal or even greater importance, the cafeteria dining room should contain adequate storage space designed specifically for the equipment that is considered essential to the various programs to be housed.

Let us take for example the use of this room for scout work. The three units of scouting should be considered—cubs, age 9-11; scouts, age 12-14; senior scouts, age 15-17.

Cub packs should have a place to keep the pack emblem and to store articles which the packs may purchase in quantity for loan or gift to the dens. Included in the list would be paints, beads, bead loom, books on handicraft work, special handicraft tools, leather, reed, and clay supplies.

The character of equipment for scouts is going to be much influenced and apparently the amount greatly augmented by the federal government's program of making surplus equipment stocks available to the scouts. In planning storage space for scouts, this program should therefore be taken into account.

There should be storage space for both the troop and for each patrol. For the troop, provision should be made for storing such items as wall tents, walkie-talkies, pails, lanterns, camp chairs, cooking gear, army trunk lockers, and outing tools. For each patrol, provision should be made for storing such items as ropes, first aid equipment, signal kits, flags, and pup or explorer tents.

As a general recreation and social room for the community, the cafeteria dining room has vast possibilities. The room should be equipped with game tables of various types, ping-pong tables, radio, and victrola. A room for hanging wraps should be so placed as to serve the gymnasium and the auditorium as well as the cafeteria. Incidentally, here again it is seen that the location of these three units in close proximity to one another is of vital importance.

The question of what to do with the dining tables and chairs when the room is used for purposes other than dining is a difficult one, and one, that if not properly answered, interferes seriously with multiple use of the dining room. Two means of handling this problem work out fairly well. One is to install folding tables and chairs and then to be sure to have adequate storage space for them. A better way is to install a fold-in-wall type of table and seat. With this type of installation, the floor can be cleared after the lunch hour with a minimum of time and labor.

In the Gymnasium

Adult use of the gymnasium and showers furnishes another example of the need for storage space. If the adults come regularly to the gymnasium, they should have lockers in which to keep their gymnasium clothes and shoes. The present practice of providing six or seven small gymnasium lockers for each large compartment locker is fairly easy and inexpensive because all each adult needs is a small locker, 7 by 12 by 24 inches, for his gymnasium suit and shoes. Street clothes can be placed in one of the large compartment lockers which are provided for regular school use.

It is not intended that the foregoing discussion of storage facilities should be all-inclusive. Many other examples of the need of storage space for multiple use of the school plant can be given.

Locate School Toilets Near Community Rooms

It is essential that adequate toilet facilities be available for the out-of-school use of the school building. However, with proper planning, two sets of school toilets, one for boys and one for girls, can be so located that they will be readily available to the three units that will see the greatest amount of general public use—the gymnasium, the auditorium, and the cafeteria.

With one exception there is not much justification for providing separate toilets for out-of-school use. The exception is the need for toilets that can be

reached directly from the outdoor playing fields without entering the main part of the building. This is a very definite convenience, particularly as the playfields are frequently in use during times when the building is closed such as late evenings, Saturdays, Sundays, other holidays and during the summer months.

Custodial Service

The question of payment for custodial service when the school plant is being used for community purposes is a troublesome one. In some places, the organizations using the building pay the custodian for his extra service which, in such cases, usually consists of opening the building, sticking around during the activity, and then locking up after the activity is over and the people have gone home.

The more common practice is for the school board to assume full responsibility for custodial service for out-of-school activities. With the increasing use of the school plant for community purposes, this is becoming, and should become, the universal practice.

In a school building with a single janitor, the janitor may need to have an assistant to look after the community use of the plant. This assistant should be employed by the board and should be responsible to the board. If the heating system has automatic controls such as may be found with an oil burner or a coal stoker, the assistant need not be skilled in firing a furnace. He should be a sober, responsible person who can clean up and straighten around after the activity is over and who can be depended upon to protect school property.

Looking after the plant during community activities need not in all cases be an extra expense. Many times it will be possible to schedule regular cleaning work during the late afternoon and evening, so that the custodian performs the dual service of carrying on his regular work while he keeps part of the building open for community use.

Shifting of equipment in a room used for a variety of purposes requires careful supervision of the custodial service. For example, in the cafeteria dining room the custodian's schedule should provide for clearing the room of tables and chairs immediately after luncheon and sweeping the floor. The room is then ready and available for other activities until the noon hour the next day, when tables and chairs must be replaced.

Another example relates to taking care of toilets which are used by both school and community. Scrupulous care should be taken that after every community affair the toilets are thoroughly cleaned and made ready for school use the next day.

Proper Planning Keeps Costs Low

One of the most gratifying aspects in planning a school plant for community use is that but little extra cost is required. There need to be few if any extra rooms added. If effective location of rooms used by the community is secured in planning the building, if the heating plant is so designed that the rooms used by the community can be heated separately, and if suitable and adequate storage space is provided, the board of education can feel assured that the community needs are well taken care of and that but little extra cost has been incurred. The cost of custodial service will be increased but with careful planning the increase can be held to a low figure.

Furthermore, in appraising the extra costs involved it should be realized that separate plants to take care of community needs would, both in construction and in operation and maintenance, be a far more costly proposition.

"As a general recreation and social room for the community, the cafeteria dining room has vast possibilities"

Courtesy of the Norris (Tenn.) Public School

DAYLIGHTING THE SCHOOL PLANT

By CHARLES BURSCH, Chief, Division of Schoolhouse Planning
and CHARLES D. GIBSON, Field Representative, Division of Schoolhouse Planning
State Department of Education, Sacramento, Calif.

THE use of any light source in a schoolroom is for the purpose of making the process of seeing easier and more comfortable. A rather sharp distinction has often been drawn between so-called "natural" light and "artificial" light. The inference was that "natural" light was the ideal source and that the goal of all lamp manufacturers was to perfect a light source which had the same color balance as "natural" light. Research has blown higher than the proverbial kite the belief that "natural" light is superior to incandescent or fluorescent light for critical seeing purposes. In the first place, there is no set spectral curve of "natural" light. Its quality varies by geographical position and again by the time of day. No one can "duplicate" it because it does not stay constant by either place or time long enough to be copied. All other factors being equal, the *kind* of light, within the common limits of "natural" or daylight and artificial light from incandescent or fluorescent lamps, has no significant effect upon the seeing process.

Overemphasis on the Footcandle

Many advocates of daylight as the primary light source for schools have fallen into the same outworn pattern of emphasis as the promoters of artificial light sources. Those intensity enthusiasts enshrined the footcandle as the magic steward of healthful eyes and the key to learning. The misplaced concern of those responsible for school lighting in that era centered about procuring quantities of raw, radiant energy. The adequacy of classroom lighting was measured in terms of how many 500 watt outlets were provided or how many fluorescent lamps were suspended from the ceiling.

Now it is well known that the footcandle was only a boy sent to do a man's job. An important rôle, to be sure, but just as surely an overrated and overemphasized one, publicized and promoted out of all proportion to its relative place in the complex process of seeing. It is most important that those interested in daylight as the major light source for schools should profit by the experience of the past and avoid the fallacy of overemphasizing the footcandle.

Quantity and Quality Factors

In the seeing process, there are many complex factors and intricate combinations of them. Since this is a highly technical field, discussion here will be limited to a brief review of several of the more basic of these factors.

Quantity

Here is one of our most repeated lighting terms. During the past twenty-odd years since the advent of the footcandle meter, interest in light and its quantity (and sometimes quality) in schools has been sustained, for the most part, by people having light energy or lighting equipment for sale. This is a normal American trend, and, in spite of some very vocal dissenters to the contrary, the good that has come from "commercialized research" far and away exceeds any and all possible harm that it may have done.

Unfortunately the term "quantity" has become associated almost entirely with the term "footcandle." This is regrettable because the amount of light falling on a task (footcandles) is only one-half the story of "quantity." The other, and visually more important half of the story, is how much of the light striking the seeing task is reflected back. This reflected or secondary light is the energy which activates the seeing mechanism. Obviously the most vital interest in the term "quantity" must be in this secondary and sadly neglected factor of footlamberts.

Quality

a. *Distribution.*—The distribution of light is one of the more measurable tests of the quality of a lighting installation. Proper distribution will result in two observable conditions: first, there will be uniform lighting over the whole working area; and, second, the illumination will be free from shadows.

b. *Glare.*—This lighting factor invariably is considered in two forms—direct and reflected. No direct glare should be tolerated from any light source, and the reflected glare from the work or surroundings should be held to a minimum.

c. *Brightness-ratios.*—This factor relates to the ratio of the brightness of the seeing task with the brightness of the general surroundings. It is only one segment of the larger and inclusive factor of brightness, but it is one of the more controllable phases of classroom lighting. Ideally, the brightness of the task and the brightness of the surroundings should be the same, but a ratio of 50 to 1 would represent an almost Utopian improvement in the great majority of schoolrooms today.

Application to Daylighting Techniques

The factors of quantity and quality of light which have been enumerated must be the minimum criteria for evaluating school lighting, whether the light source is daylight, artificial light, or both. The remainder of this article will deal with the application of these factors to classrooms using daylight as the principal source of light.

Footcandles

Footcandles, as the units for measuring the primary light intensity falling on a task or surface, owe much

of their popularity to the fact that they can be measured easily. The footcandle meter is the one light-measuring device in common use. Of course it can be used to measure the amount of reflected light from a given surface too, but this technique has not been developed to any great extent by the pseudo-lighting specialist.

In modern school plants properly designed for daylighting, it is common to find minimum intensities ranging from 50 to 100 footcandles during the normal school day. The high intensities sought for so long by many light-conscious people are an accomplished fact in many daylighted classrooms. This fact makes emphasis on lighting factors other than footcandles all the more important.

Footlamberts

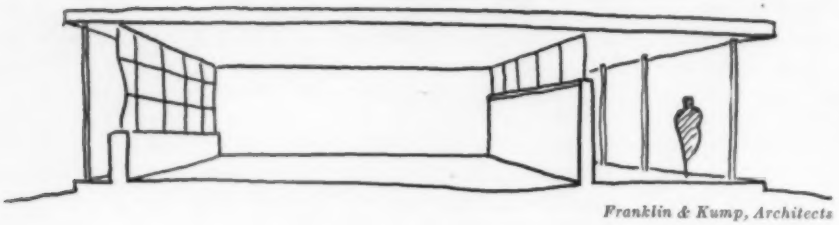
The footlambert, as the unit for measuring the secondary light reflected from a surface, has replaced the footcandle as the most significant factor in the lighting field. All that is needed now to make this change in emphasis popular and universal is a simple instrument for measuring the footlambert unit objectively and accurately. The brightness-meter in its present form is a step in the right direction, but improvements must be made before the measurements can be considered objective rather than subjective.

The change of lighting emphasis to the footlambert will make school designers much more conscious of the quality-lighting factors involved and the necessity of giving the proper weight to each.

Distribution

Uniformity of illumination and freedom from shadows have been most effectively obtained by the use of a bilateral lighting system. In this system the ceiling plays an important part in eliminating shadows, by diffusing a major portion of the light it receives from both banks of windows. In situations where bilateral lighting is not practical a measure of uniformity of illumination may be obtained in a unilateral installation. This can be accomplished by increasing the windowhead height and placing it flush with the ceiling. A minimum windowhead height of

A high level of well distributed natural light introduced bilaterally. ". . . the ceiling plays an important part in eliminating shadows, by diffusing a major portion of the light it receives from both banks of windows"



Franklin & Kump, Architects

Bilateral lighting: principal windows north; high south windows under cover produce high even light level and permit increased span with acceptable daylighting

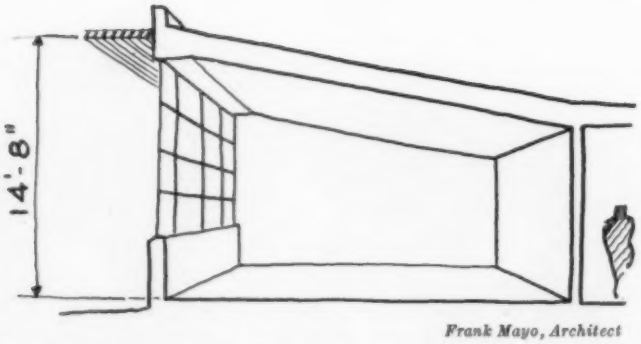
14 feet would be required in a classroom span of about 24 feet.

Well-distributed and shadow-free light, both by-products of a uniformly lighted ceiling, become all the more important in a school where pupil seating arrangements depart from the traditional fixed stations. This modern educational practice requires that every available square foot of room area be usable for critical seeing tasks and makes it imperative that more attention be given to light distribution.

Glare

Glare is the result of an unbalanced lighting environment. An uncomfortably bright sky, bright clouds, bright building exteriors, or small glass panels in solid wood doors are troublesome glare sources. They are particularly distracting when viewed from interiors where intensities and brightnesses generally are at a low level. Surfaces with a specular reflection such as glass table tops, glass covered pictures, or glossy varnished surfaces are glare sources.

Glare is so closely associated with brightness-ratios that it will be discussed more in detail in the following paragraphs.



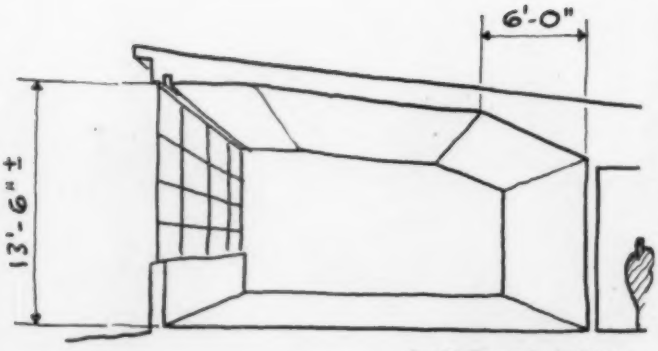
Frank Mayo, Architect

Unilateral lighting: improved by extra glass and windowhead height. East sunlight partially controlled by louvers

Brightness–ratios

The application of acceptable brightness-ratios to the schoolroom offers more opportunities to improve the lighting environment than does any other one factor. Lighting specialists have done a good job selling mat-white ceilings and upper walls of a light color. This practice was established to increase the footcandle intensities at desk-top level. Its greater value may be measured by the fact that it was a start toward establishing acceptable brightness-ratios in the classroom. Now all that needs to be done is to extend the practice of providing higher reflection-factor surfaces to the lower part of wall, across the floor, and over all the furniture and equipment. There will not be an adequately illuminated classroom until this is done! Within the classroom itself, the ratio of brightness between the immediate visual task and the darkest surface in the room should not exceed 10 to 1. The brightness-ratio between the darkest surface in the room and the brightest window area within the range of vision should not exceed 50 to 1.

To make a brightness-ratio of 10 to 1 possible within the classroom area, it will be assumed that there is an abundance of glareless, well-distributed, shadow-free light. This does not need to be an assumption in a school plant that has been properly designed for daylighting. It is a reality. The blackboard, the darkest area in the average classroom, presents an excessive contrast to a mat-white ceiling of approximately 80 per cent reflection factor and side walls which reflect an average of 40 per cent. Postwar resumption of the manufacture of light-colored



Carl F. Grommé, Architect

Unilateral lighting: improved by extra glass, extra windowhead height, and by sharp ceiling slope over darkest classroom area

chalkboards can solve this "darkest" problem. Enough experience was gained through prewar installations of light green chalkboard to assure the practicability of this new writing panel.

Woodwork, furniture, and equipment finished in pastel shades are past the "maybe" stage. Some schoolrooms have been painted and furnished with the student in mind, rather than the maintenance superintendent and janitor, and that practice must become more widespread. Higher reflection-factor surfaces on the furniture and equipment can be possible only when the manufacturers of these articles receive enough demand for them. The "schoolroom browns," dark greens, and blacks are manufactured because many school authorities buy them without question. Most manufacturers will resist the change from a finish with a 3 per cent reflection-factor to one with a 30 per cent reflection-factor for obvious reasons, but they will make the change when the market demands it.

Mottled-pastel colors in floor tiles and light-colored wood floors have proved their many advantages over long years of highly satisfactory service. The value of these higher reflection-factor floor surfaces becomes more appreciated as the trend grows toward more tolerable brightness-ratios.

Brightness Control

Two distinctly different methods of using daylight as the major light source in schoolrooms have been used in an attempt to attain a brightness-ratio of 50 to 1 between the brightest window area and the darkest large surface in the classroom. Both methods use the same general one-story building design with an open corridor and bilateral lighting.

The first and most used method orients the large bank of windows to the north. No shades, blinds, or other daylight control device are used on these large windows. The transom windows facing south are protected from direct sunlight by an overhanging corridor roof or by fixed louvers and often by Venetian blinds. These rooms on clear days have a minimum daylight intensity ranging from 50 to 100 footcandles during the hours school is open. No direct sunlight enters the room. When the room interior is finished with proper illumination in mind, and as long as the north sky remains close to its average brightness, this daylighting method will come close to insuring 50 to 1

Gloom and glare produced by inadequate glass area

brightness-ratios. Extreme sky or cloud brightness in the north sky vault will do discouraging things to this ratio but certainly will not create any worse critical seeing conditions than are now experienced in the average classroom. This method is based on the thesis that, by maintaining high footlambert levels inside the classroom, the fully exposed, average north sky becomes an acceptable unshaded light source.

The second method would take the same classroom and completely louver both banks of windows. By using scientifically designed louvers on the large amount of glass made available by the bilateral system, it is possible to reduce the extreme brightness-ratios to 10 to 1 and maintain approximately 30 footcandles of very evenly distributed, glareless light in the room. This method makes it possible to orient the building north, south, east, or west and still maintain a near perfect lighting environment.

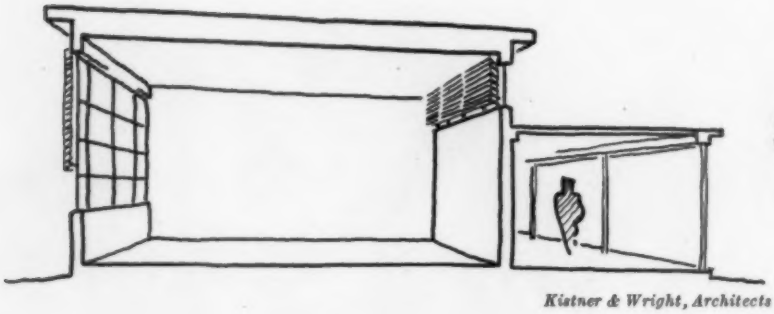
Daylighting and Classroom Design

The bilateral introduction of light into classrooms has made it possible to break with traditional room design. Unilateral lighting of classrooms tends to limit their width to a practical maximum of 24 feet. When both sides of a classroom are used for admission of daylight, the width of the room may be increased without resorting to excessive ceiling heights. The well-lighted, square-type classroom thus made possible is considered more desirable than the traditional type by some educators, especially where larger per-child areas are provided for informal educational programs.

The type of building which has resulted from the attempt to use as much north or east exposed glass as possible in daylighting classrooms is unsuitable in severely cold climates. Severe climate, however, need not deny classrooms the lighting advantages of increased glass areas conditioned for control of glare with a minimum of teacher or custodial adjustment.

Obstacles to Improved Daylighting

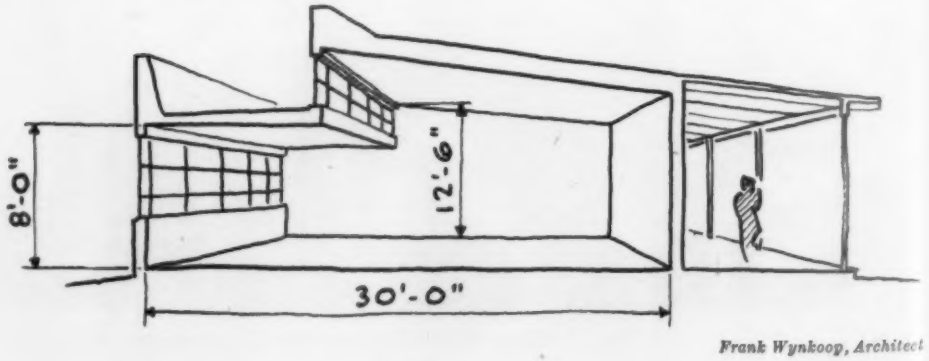
Numerous recent school structures have amply demonstrated that the gloom and glare found in traditionally daylighted classrooms can be overcome. This has been accomplished not so much by discovering a pat solution as by a recognition of the shortcomings of existing standards and by working for improvements. The greatest hurdles encountered thus far have been the strange building appearance resulting from a straightforward design for improved classroom lighting, the high regard for large areas of slate chalkboards, and the schoolroom "standardization" on dark finishes for furniture, equipment, wainscot, trim, and floor. Still another potent hurdle is the objections of teachers to north-exposed windows in classrooms. These objections usually disappear when



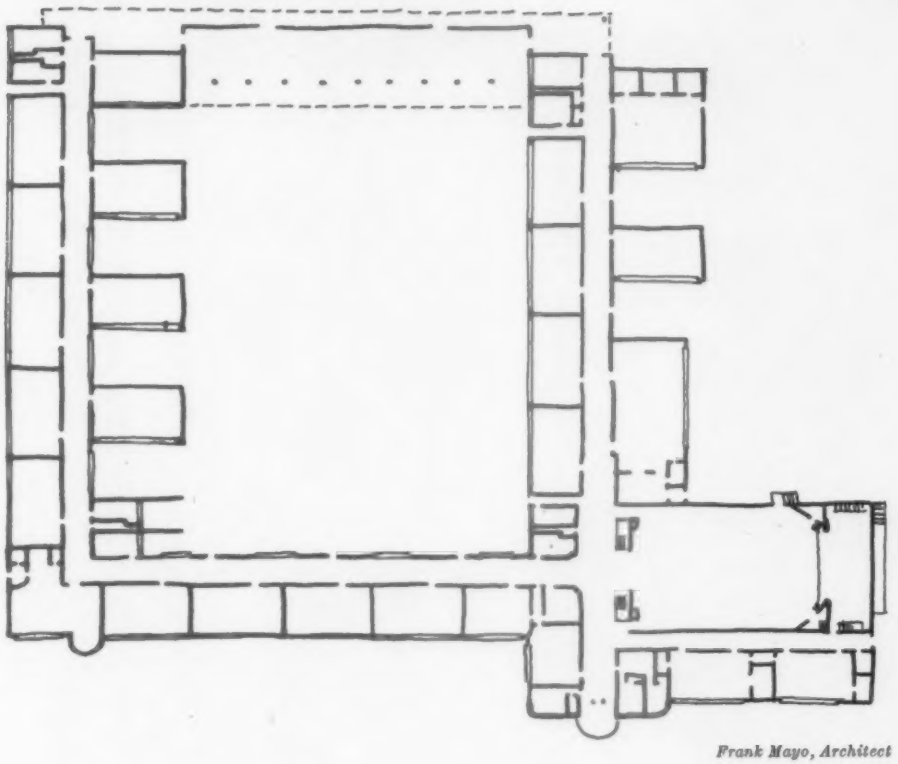
Bilateral lighting: even distribution from any direction secured by outside louvers. Extra glass area to partially offset darkening by louvers

Kistner & Wright, Architects

Unilateral lighting: north clerestory feature for the purpose of daylighting extra width; for square type room



Frank Wynkoop, Architect



Building arrangement meeting requirement that all classroom windows face north or east (see second sketch)

Frank Mayo, Architect

teachers experience the difference between traditional north-exposed classrooms with low glass areas and dark finished interiors, and modern rooms with maximum glass areas and light-colored finishes with low brightness ratios. These enemies of well-conditioned daylighted school buildings are all in the process of being liquidated.

The foregoing discussion has accomplished its purpose if it has in the slightest accelerated that liquidation.

Definition of Terms

Agreement on terminology is necessary to intelligent discussions. Some lighting terms are often confused with others. Still others have grown rather general in meaning as they have come more and more into common use. For these reasons and also because it is necessary to draw lines of distinction between certain lighting factors, the meaning of the following terms are offered as they are used in this article.

Bi-lateral light.—Light coming from opposite sides.

Brightness.—The brightness-level of an object created by the reflection or transmission of light.

Brightness-contrast.—The contrast expressed in per cent between the brightness of the critical details of a seeing task and their immediate background, viz.: the contrast between the brightness of the black printed words in a book and the white paper background. This factor is limited to brightness differences within the immediate seeing task.

Brightness-ratios.—The ratio of the brightness of the seeing task to the brightness of the general surroundings, viz.: the brightness-ratio between the white background of the printed page and the desk top, chalkboard, walls, equipment or floor. Some liberty has been taken with this term in this article since it was related to two conditions: first, the ratio between the seeing task and the surroundings *within* the classroom; second, the ratio between large areas in the classroom and sky brightness.

Brightness meter.—An instrument used to measure brightness.

Candlepower.—The luminous intensity expressed in candles of a point source of light. This term applies only to a light source. It is a technical term not generally within the understanding of the lay person. It should not be confused with the footcandle.

Distribution.—The general "spread" of light over any given area.

Footcandle.—The amount of light produced on a surface one foot square at the distance of one foot from a standard candle. This is the unit of intensity or quantity of light falling upon any given surface.

Footlambert.—The most common unit of brightness. It is used to measure the average brightness of a light source or the average brightness of any reflecting surface. 100 footcandles fall upon a white piece of paper with a reflection factor of 80%. The paper absorbs 20% of the light and reflects back to the eye 80 footlamberts.

Footcandle meter.—An instrument used to measure footcandles.

Glare.—Any brightness within the field of vision of such character as to cause annoyance, discomfort, eye fatigue or interference with vision.

Direct glare.—Glare coming directly from some light source.

Reflected glare.—Glare reflected back to the eye from some glossy surface.

Light.—The raw, visible radiant energy from any light source.

Lighting.—The result of turning light into a constructive, usable energy for seeing.

Mat.—A surface without luster; "flat"; without gloss.

Reflection factor.—The percentage of light reflected by any given surface.

Unilateral.—Light coming from one side.

PLANNING HOUSING AND EQUIPMENT FOR A VOCATIONAL PROGRAM

By HARRISON C. GIVENS

Director, Natchitoches Trade School, Natchitoches, La.

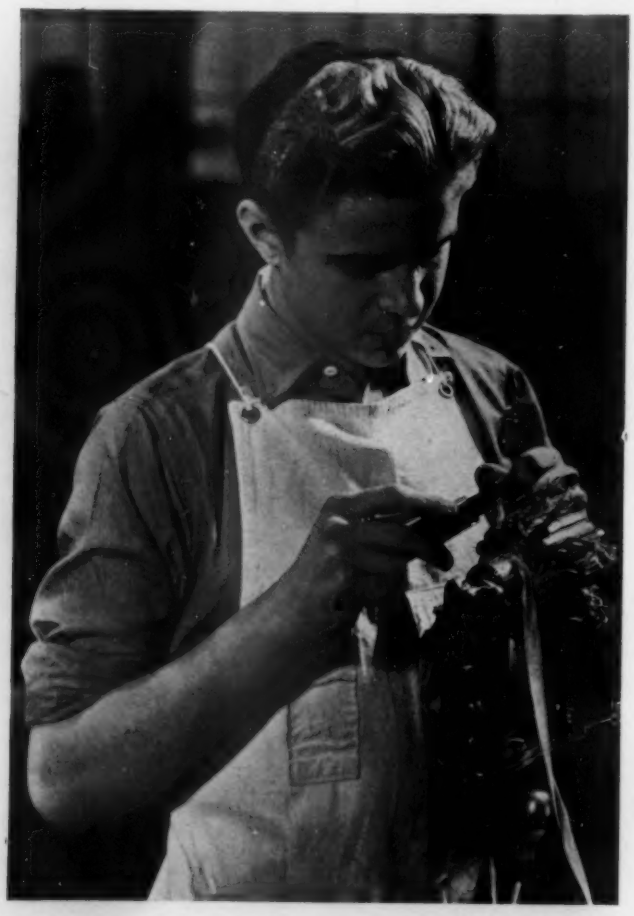
THOSE who are responsible for the educational program in a given area have the responsibility of approving the equipment lists and housing facilities for any vocational program in their area.

If the program is to serve the area to the maximum; if the school patrons and community are to be completely sold on the type of program offered; if criticism of the program, its equipment, and housing is to be reduced to a minimum, a planning procedure different from that usually found must be followed.

Design Classrooms First

In an article entitled "The Planning of Classrooms for Postwar School Buildings" appearing in the January 1944 issue of *The American School Board Journal*, Charles Bursch in discussing better schoolhouse planning procedure from the point of view of educational usefulness says:

> The key to the recommended procedure is to have competent persons plan classrooms for specific types of educational service and then organize those classrooms into a workable school building. The planning procedure may be termed successful when it results in a school building composed of classrooms whose sizes and shapes facilitate the adopted educational program and practices, when all of those spaces are sound conditioned and have adequate and easily controlled lighting, heating, and ventilation. Then and then only is a school building worth what it costs, is it worth being made beautiful, safe structurally, easy and inexpensive to maintain.
>
> When the superintendent of schools and his entire staff really go to work on plant planning problems, it is inevitable that a different set of values, a different ranking of planning elements than has heretofore prevailed will emerge. Local school administrators and school architects often shudder, at first, at the consequences of planning a school building from the inside out; of designing and orienting classrooms first and then organizing them, unimpaired, into the best-looking school building possible. It is granted that the resulting buildings may bear little or no exterior resemblance to traditional schools.



What occupation will he enter? This is the first consideration in planning the housing and equipment for a vocational program

Application of Procedure to Vocational School

Considerations effecting the application of such a planning procedure for a vocational program are many. They necessitate:

1. Organization of an advisory committee.
2. Determination of the need for each unit in the vocational program, the types of programs to be offered and their objectives. If this is not done, selecting the equipment and planning the housing cannot proceed intelligently.
3. Selection and location of equipment, tools, etc., which will make it possible to reach the desired objectives.
4. Planning of suitable housing for the equipment, suitable storage space, etc.
5. Securing the necessary funds to carry out the plan.

Failure to take into consideration certain underlying principles present in each of these factors has resulted in the unsatisfactory conditions frequently found in connection with the school shop. When an old school building is turned over to the vocational program, when the provision for the shop work in the new building is simply the combination of two or three standard classrooms, or when shop space and equipment are based upon incomplete information and analysis of what offerings should be made available, the chances are that the physical arrangement will be neither proper nor adequate.

Valuable as they may be, housing and equipment specifications of other vocational schools, shop lay-

Westinghouse photos

Those responsible for the vocational program should consult management and labor. Each can contribute definite information concerning industry's needs and the type of courses which should be offered

outs and equipment lists furnished by vocational education equipment salesmen, should be used with discretion. They may or may not fit conditions in the local area. Idle equipment in some shops and idle shops with adequate equipment are primarily the result of incomplete analysis of conditions effecting the program.

Analyze Needs and Outline Program

Determining the needs for each unit in the vocational program, the types of programs to be offered and their objectives is as much of a business proposition as is selecting the equipment and planning the housing for the program. Management and labor, as well as those responsible for the educational program, must have a voice in the matter. As the employer of the product of the vocational training program, management has a definite knowledge as to what it needs and what it can contribute to the training program. Labor, into whose ranks the product of the school will go, likewise has its own viewpoint in regard to a training program. Those responsible for the vocational education program must secure their cooperation and help. Certain information must be secured and analyzed, and from it a vocational program planned for each unit to be offered. The analysis must show that there is a definite need for the course. It will determine the type of program, the objectives, and give the basis for preparing all outlines of courses to be offered.

The number of persons who can be absorbed into the industry each year may be too small to justify the establishment of a unit type pre-employment training program. On the other hand, there may be enough in two or three different trades to justify the establishment of a general shop course; one in which each student receives training in the basic skills and technical knowledge in each of these trades. It may be that conditions will show that one of the other types of vocational programs should be offered.

The age, academic, and other requirements for entrance into the occupation will determine to a large extent the type of program and the grades in which the course should be offered.

Technological development, state and federal labor legislation, social security legislation, compulsory school attendance laws, workmen's compensation and labor policies are quite likely to change the picture in the development of vocational training programs in the near future, and must be taken into consideration in determining the type of courses to be included in the program, etc. As an example: During the training of war production workers the necessity for a highly specialized training program was universal. During this period there also developed a need for technical vocational training; a type of training to prepare persons for, or to upgrade them in the technical occupations for which engineering school graduation is not required. It is work beyond that of the regular trade school program in that it stresses definite industrial application of the laws of science and technical knowledge and the necessary skills involved. It is now quite evident that in planning a vocational program consideration will have to be given to the fact that in some occupations short, highly specialized training is necessary, while in oth-

ers the broader, technical vocational training is the type which is needed.

Having determined the type of program, and knowing exactly what to expect to secure from the training offered, then, and only then, can an intelligent outline of the course be prepared and the equipment selected.

Select Equipment

An analysis of the outline of the course of study will indicate what equipment is needed and how many of each type must be provided. Certain fundamental principles should govern the selection of equipment for a vocational program.

1. The equipment and tools selected must be in accord with the objectives set up for the unit. Obsolete equipment, or equipment which has nothing but tradition to justify it, should be eliminated. Equipment which does not contribute directly to the program, even if it cost only transportation charges, should not be included. Even if free equipment is of the kind and size desired, it should be inspected and its value determined before its inclusion on the equipment list.

2. Equipment should, in the main, be representative of the best found in that trade in the area (sometimes even of later design), so that the student while in training may secure experiences comparable with those he will encounter when he enters employment. Industry, if it wants to stay in business, retools its plant every few years. School systems seldom provide for any retooling of school shops other than replacement. Why?

If these principles are followed it will usually be found that:

1. The machines are of standard design and of good construction.

2. The machines are equipped with individual drives which provide for maximum efficiency and flexibility of arrangement.

3. The machines are of a kind and capacity which will take care of all training needs and the bulk of any work which the shop may undertake.

4. The machines are equipped with adequate protective devices and safety guards.

5. The small tools and accessories are of the best grade obtainable.

Plan Arrangement of Equipment

When the equipment has definitely been decided upon, the problem of arranging it for efficient instruction is ready for study. In deciding the shop layout, such questions as the number to be enrolled in a class and the instructional procedures to be followed in the carrying out of the course of study must be considered, as well as the size of machines, benches, and auxiliary facilities.

The arrangement of shop equipment must be considered first, from the standpoint of educational efficiency; second, from the standpoint of modern industrial practices. It should, as far as feasible, parallel the arrangement in an efficient and modern establishment in which the product of the training will find employment. An efficient shop layout is the result of trying many different arrangements and the selection of the one which most nearly provides an ideal arrangement for instructional purposes.

The arrangement of the equipment and auxiliary facilities should determine the shape and size of the room. The usual procedure is the reverse.

Principles of Layout

For efficiency in instruction, some of the principles which need to be applied when arranging equipment are:

1. That every area is visible from any location in the shop. Placing a piece of equipment in a position which hinders a clear view of the entire shop is undesirable from an instructional standpoint. Such an arrangement may result in a room larger and more nearly square than is usually found. A room whose length is more than twice its width is not the most desirable from the standpoint of efficient instruction. The instructor is often too far away to see when a student needs help.

2. That auxiliary facilities, such as supply rooms and tool cribs, are adequate and located so as to provide for a minimum of traffic and traffic interference. There can be found many instances in which apparently little thought was given to this part of the shop layout. From the standpoint of conserving student time, as well as ease in handling the group, it is one of the most important. A tool room located at the end of a shop 24 feet wide and 70 or 80 feet long necessitates considerable traffic. A room 40x50 with the tool room on the long side would reduce traffic and would make it easier to provide distinct traffic isles, thereby lessening traffic interference. Moreover, the instructor never is far away from any student.

Insufficient space in tool rooms and in supply rooms is due to failure to consider what is to be kept in these rooms and how it is to be arranged. A good arrangement is important from the standpoint of convenience in obtaining tools and supplies, and in lessening the chance of congestion of students at these points. One method of reducing traffic interference and congestion is to provide facilities for keeping tools and accessories at the point where they are to be used. In other words, everything which may be required for a given machine is at that machine, and for a given type of work at the work station.

3. That work stations are so located that

(a) Related activities are in close proximity.

(b) There is no danger of interference from an adjacent worker or from the work he is doing.

4. That the job of keeping the shop and equipment clean is reduced to a minimum.

5. That a certain amount of flexibility and expansion is possible since it may be desirable to change the set-up to meet changing conditions.

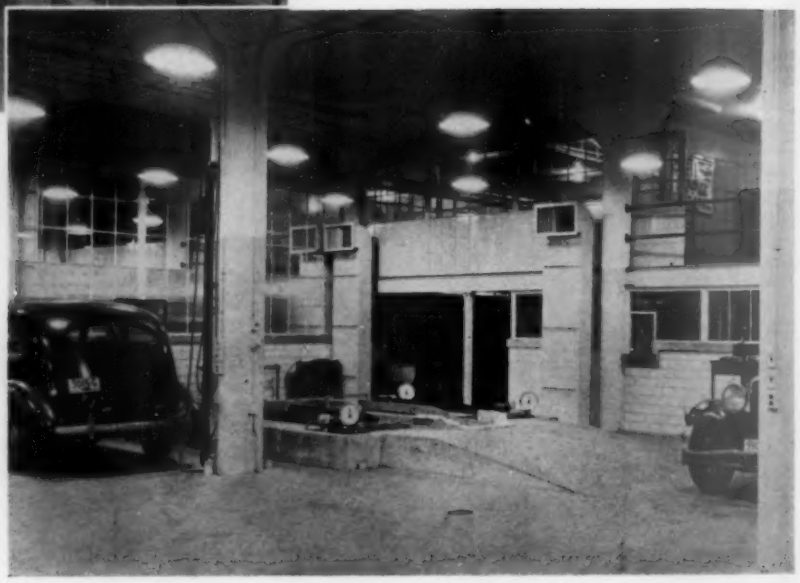
Submit Tentative Sketch and Complete Plans

When the tentative shop layouts are completed, consideration for the housing of the program can be taken up with the architect. There is now available for his use tentative single line sketches showing the size and shape of the rooms required for each unit in the vocational program. On them are shown the equipment layout, the location, size and shape of auxiliary facilities, etc. Failure in the preliminary sketch to include all items which take up space, and to make provision for expansion, frequently result in

Above—Arrangement of work stations in the welding shop of the Macomber Vocational High School, Toledo, Ohio, allows each worker freedom of movement

Below—A safety device in the Macomber Vocational High School is the large panelboard which enables the instructor to cut off equipment without delay

The artificial lighting in the printing room of the Macomber Vocational High School provides an average intensity of 41 footcandles



The auto service and repair shop of the Macomber Vocational High School features a blower system for the removal of exhaust gases

a room too small for efficient instruction or supervision.

Planning the housing involves the combining of the various layouts and rooms for the entire program in such a way that the arrangement will function efficiently. This necessitates

1. Careful step by step work with the architect with constant checking of all items. Construction details and other factors may possibly necessitate changes from the original sketch. The time to check and approve these is before the contract is let.

2. The selection of someone thoroughly competent to inspect and supervise the work, and who is empowered to make independent decisions right on the job.

There are countless details which will have to be worked out. It will prove advantageous to include suggestions for some of them in the tentative sketch. They include such items as

1. *Electrical outlets for all power machines and services.*—The number and location of service outlets should be shown on the tentative layout. Most shops have too few to take care of the increased use of portable electric equipment and plug in fractional horsepower motors used as individual drives on machines. Some recommend overhead lines to give flexibility.

2. *Compressed air outlets.*—It is better to put in a few extra ones than to have to use a long hose and replace it frequently.

3. *Gas and water outlets.*—For these one never should have to say too few or too small.

4. *Lighting.*—Traditionally natural lighting is preferable. However, it will not alone provide adequate illumination in some parts of the shop, and on dark days it will often prove to be inadequate for all areas. Large glass areas, unless limited to the north side, will usually result in direct sunlight glare in some part of the shop during the day. The student who has to face the window with more or less glare from the sun, or whose work station places him between his work and the source of light, encounters a distinct handicap. With light only from the north side, the glass area must be large and the room high to get even a fair light at the other side of a room 24 feet wide. If the desired room proportions are maintained, shops will be more nearly 40 to 60 feet wide, and natural light will be even less satisfactory.

Complete artificial lighting is being used in many buildings, and with the development of fluorescent

lighting many are advocating that the rigid lighting requirements for school shops be fully met with artificial light. Unquestionably, with artificial lighting the minimum of 25 lumens for ordinary work and 40 for fine work can be secured throughout the shop regardless of outside conditions or the amount of natural light available. Moreover, certain handicaps resulting from poor light can be eliminated.

5. *Floors.*—Maple flooring with rubber safety mats for all machines is desirable in some shops. In those shops dealing with hot metal, and where grease and dirt are common, a floor suited to the conditions which prevail should be chosen.

6. *Heating.*—Heating units should be placed so as to avoid occupying flood space and interfering with operations.

7. *Height of room.*—The ceiling height shou'd be determined by type of work to be carried on in the shop. In general, ceilings should be not less than 12 feet high.

8. *Removal of dust and gases.*—Provision should be made for a blower system to remove shavings from wood shops and for the removal of exhaust gases from automobile engines and from other activities where gases are developed. From the standpoint of health such provisions are necessary, since many persons are allergic, or become allergic, to dust and gas fumes.

9. *Waste removal.*—Consideration must be given to the disposal of sweepings and scrap from each department.

10. *Ventilation.*—Amount and circulation of air is an important item in the control of work conditions. Air conditioning is desirable.

Determine the Cost

When the equipment lists and building plans have been completed, the cost of instituting the program can be determined. Funds sufficient to carry out the full program can then be requested.

The Right and the Wrong Way

The two block diagrams which follow show a comparison of the procedures discussed with the procedures frequently followed in planning equipment and housing for vocational programs. The procedures shown in the first block diagram should result in providing adequate facilities and conditions for a functioning program in a suitable building. The other procedures may or may not produce corresponding results, and frequently do not.

Procedures Discussed

Need for the program determined. Type of course and objectives decided upon. Tentative outline of course prepared.

↓

Equipment selected on the basis of its suitability to function in meeting the decisions made above. Tentative equipment layout made by those responsible for carrying on the program from the standpoint of efficient conditions for instruction.

↓

Building plans, specifications, etc., prepared by architect. These are based on the above layout, with constant checking by those responsible for tentative sketches. The total cost quite accurately determined.

↓

Funds secured for instituting the program.

↓

Construction and installation under the supervision of a competent person directly responsible to the school authorities as well as to those furnished by the architect and contractor.

Usual Procedures

Need for the program determined. Type of course and objectives decided upon.

↓

Estimate made of the equipment and building cost. This is frequently obtained from the cost of other programs rather than from any detailed study.

↓

Funds procured for instituting the program.

↓

Building plans, specifications, etc., prepared by architect. These are based on suggestions and tentative equipment layouts. The design is likely to be based upon appearance, rather than on a functional basis. Its cost must be kept within the designated amount. There is usually only a limited amount of checking by those directly responsible for carrying on the program.

↓

Construction. Frequently the architect is the only one directly responsible to the school authorities for supervision.

↓

Equipment purchased. This must be kept within the designated amount. Equipment installed as far as possible on a functional basis in the room assigned.

HOUSING AND EQUIPPING SPRINGFIELD'S VOCATIONAL PROGRAM

By GEORGE A. BURRIDGE

Principal, Springfield Trade School, Springfield, Mass.

IN the early stages of vocational education in the public schools, classes were organized, in most instances, to care for maladjusted boys—boys who could not, or would not, become adjusted to the regular curriculum of the secondary schools. It was assumed that the proper thing to do was to provide shops where these boys could be given hand work, or, as it came to be known, "manual training." Almost any room that happened to be available was put into service—usually a basement room not suitable for classroom work was the one selected.

Invariably woodworking was the first course since materials were comparatively inexpensive and elaborate equipment was not necessary. Much work could be done with a limited number of hand tools. It was a natural beginning, and, of course, a justifiable one, but this was the true concept upon which vocational education was to progress.

With the organizing of the vocational school as a separate institution, about 1910, there came a change in concept. It was felt that trade courses offered in vocational schools should be organized in accordance with the needs of the particular community to be served, that enrollees should be selected on the basis of their ability to profit by the instruction given in such courses, and that ultimately they should be able to find places in the industries of the community. This newer concept of vocational education and its purpose made it possible to enroll an increasing number of well-adjusted students eager to learn a trade.

Growth of Program in Springfield

It was in 1909 that a vocational program was started in Springfield, Massachusetts. Two instructors and 38 boys comprised the full personnel. Woodworking was the first course offered.

In 1911, the Massachusetts State Legislature passed an act which had as its primary purpose to aid in promoting vocational education. The School Committee of Springfield, realizing the possibilities in this new form of public education, applied for state aid. As a result of the impetus given by this aid, the vocational program was expanded, new courses were added and the school moved to larger quarters in the loft of a factory building. Later it was moved to an abandoned grammar school building. Following the first World War the demands for this type of education made it necessary to erect a new building which was occupied in 1921. The school functioned as a trade school for boys until 1934, when a consolidation was effected between the trade school and the continuation school which had been serving boys and girls under sixteen who were employed but were required to attend school for four hours each week.

With this consolidation came the addition of trade courses for girls. It was necessary to use rooms in five different buildings in order to accommodate boys and girls desiring admission. Waiting lists were mounting; it was obvious that such a housing arrangement could be only temporary and that the problem of adequately providing for the growth of the school was still facing the school authorities.

A New School Is Planned

It was at this point that the idea of planning and erecting a new school to serve Springfield and the surrounding towns was conceived, and in 1934 a study was begun to ascertain the vocational needs of the community. Where should the school be located? What were the job opportunities? What were the training requirements? How diversified were our industries when compared with those of other communities? These and many other questions had to be answered before plans, or even sketches, could be made of the new school.

The first step taken in this direction was to determine mathematically the geographical center of the trade school population. As the result of a three-year study, a building site was selected within a quarter of a mile of the population center of the school. Next came surveys of the employment needs of local industries to determine as accurately as possible which courses should be expanded, which should be discontinued, and which new courses should be added in order to meet these needs. Various fields of employment were studied, including automobile mechanics, baking, electrical work, machine shop practice, pattern making and printing.

Springfield, a city with a population of approximately 160,000, is primarily a "machine" city—the dominant industries are either in, or closely associated with, the metal trades. Because of this fact, the most

comprehensive study of industrial requirements was made in the metal trades field.

Aim and Scope of the Survey

Following are some of the more pertinent points covered in this study:

The Local Aspect

Does the range of vocational training being provided adequately reflect the range of employment in the community for which training should be given? Is the local program in complete balance with community needs?

Does the training provided adequately prepare young workers for entrance into employment?

Are enrollments for training so distributed as to insure training for each local employment in proportion to the current demand for workers in that employment, or have enrollments for any reason been permitted to get out of balance, with the result that training is being provided for youths in relatively large numbers for some employments in which the demand is relatively small and is not being provided adequately to meet the demand for workers in other lines?

Has any procedure been set up for keeping accurate and continuous accounting of current changes in industrial processes, practices, materials, and equipment, which impose new training requirements upon the school to meet present conditions?

Has any procedure been set up for keeping industry and labor informed as to the school's program of service?

In a word, is vocational education functioning properly in serving the interests of workers, of industries, and thereby of the community as a whole?

The State Aspect

The experience of any community which seriously sets about to answer this question for itself, as Springfield has done, should be of interest not only to that particular community, but in some measure at least to other communities confronted with similar problems.

As a state enterprise, one chief purpose of the Springfield survey has been to develop and try out tentative schedules and procedures for the survey of present conditions, for a continuous accounting of changes in these conditions, and for the maintenance of continuous contact with industry. Such procedures may be found suitable for adoption by other communities in a state proposing to undertake similar inquiries under a state plan for gradually building up local programs that will severally reflect and serve local needs.

Accordingly, while the primary purpose of the present survey has been to aid the City of Springfield in its effort to perfect and promote its own vocational program, the work has been conducted throughout as an experimental undertaking.

Organization and Conduct of the Survey

Under the supervision of the director of the Springfield Trade School, one member of the school faculty was released from part of his teaching schedule in order to visit personally places of employment and to establish direct contact with employers, so as to secure with their cooperative assistance first-hand, detailed, and accurate information.

The man chosen was one skilled industrially, having a full appreciation of the need for accuracy in reporting conditions, and personally qualified to undertake the task.

Data Gathered by Investigator

After each visit, a schedule for the plant was filled out by the observer from notes taken in conference with an official or officials of the concern. Entries on these schedules were subsequently abstracted and summarized in tabular and chart form for inclusion

Springfield Trade School. Erected 1938-1940. Total floor area, 260,000 sq. ft. Number of rooms and shops, 117

in the survey report of findings. The following information was secured;

1. Number of workers in each occupation classified by sex, age, and status as apprentice or learner.

2. Period of training reported to be required for each occupation.

3. Number of youth 16-21 years of age in training at the school and in industry, and number graduated from school training in 1932.

4. Number of workers in each occupation for whom training is provided in school or in industry, and number for whom school training should be organized, on a basis of one learner to every five workers.

5. Size of plant group—number of workers in each occupation (industrial) distributed by total number employed in all occupations by the individual firms.

6. Size of plant group. Number of firms employing specified number of workers in each occupation (industrial).

Employers were asked to comment on vocational courses and to offer suggestions. The following excerpts taken from the comments of machine shop executives prompted the school authorities to modify the courses offered.

We hesitate about hiring young fellows because none of them seem to have had any training or instructions in safety.

I am glad that you school men are coming to your senses. You are beginning to realize that less attention should be given to the so-called toolmaking trade, and more emphasis should be placed on the training of skilled specialists or operators.

The first year's training should be on production. After that, select those who can be and want to be toolmakers. Let the others specialize and you will have fewer boys dropping out. When a boy leaves you after one year, what has he to sell?

Surveys in other fields brought about substantiallly the same results.

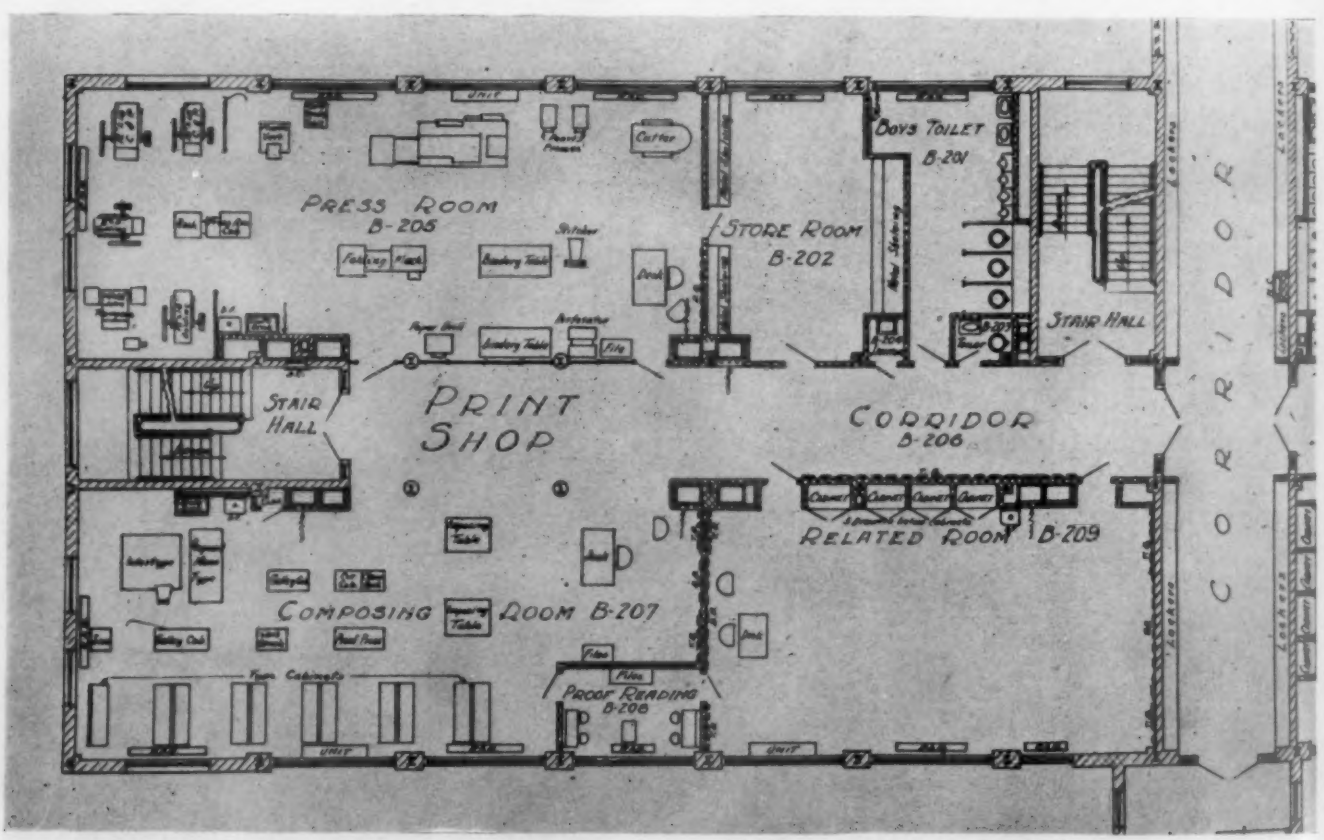
Programs and Schedules Established

Paralleling the studies being made of industrial Springfield, school officials were evaluating data and attempting to determine the number and kind of courses to be provided for in the new building. It should be remembered that all of this was taking place in the days before the war when it was extremely difficult for the untrained to secure jobs.

Many of the boys and girls desiring to enroll in vocational courses were not capable of doing the school work required in the regular trade courses; consequently, so-called "general," or short unit courses, were added to the curricula.

The schedule for the three-year course provides for 50 per cent shop time, 25 to 30 per cent related subjects, and 20 to 25 per cent general academic subjects. After a careful consideration of various schedules it was decided that the so-called "week-in and week-out" shop plan was the one best suited for the boys' courses.

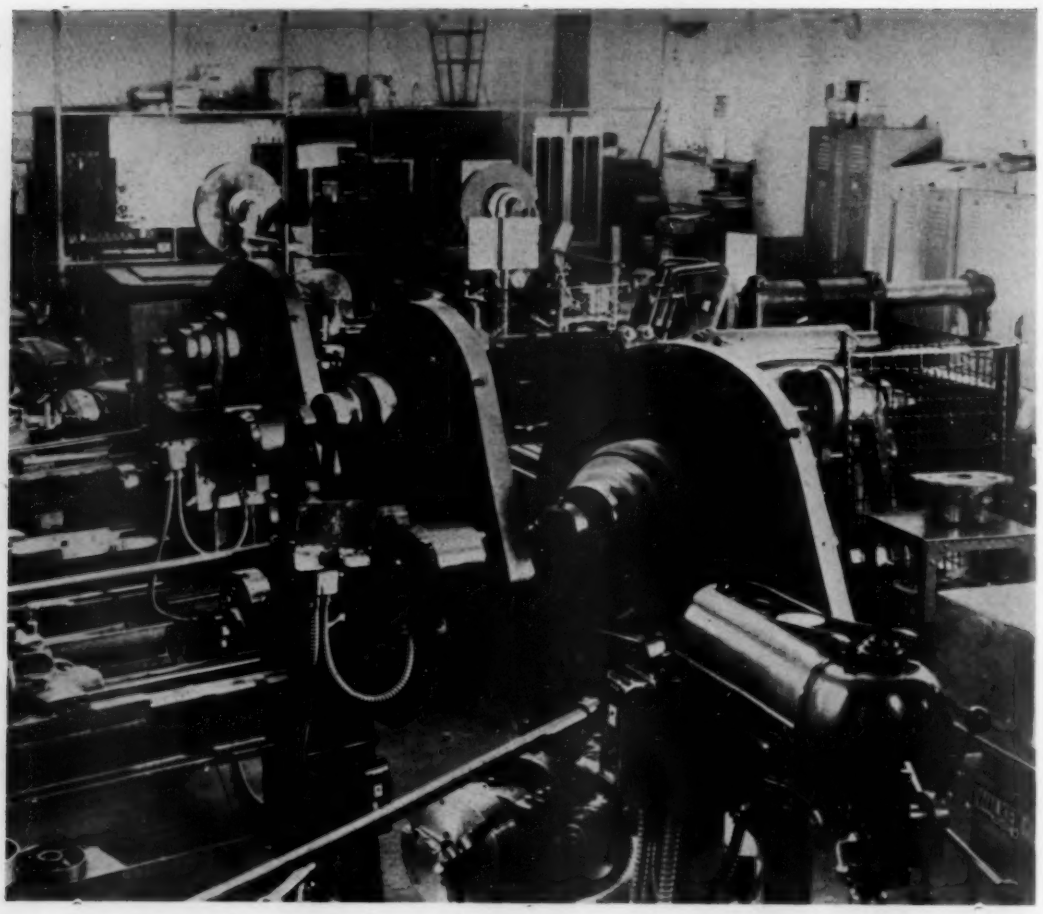
The necessity for sustained interest and repetition of operations until habits become fixed is so essential in any of the mechanical trades that long periods are necessary if efficiency is to be attained. Short periods in a shop program create a condition of frequent interruptions and ultimately lead to habitual indifference. The general courses planned for in this program



Building "B," second floor: This plan for a printing department has worked out well. The proximity of composing, proof reading, and related rooms contributes to efficiency. When operated to capacity, three instructors are required

The repair and upkeep of a modern automobile require the use of the various types of testing equipment shown in this room (D 114)

Corner of press room (D 216), showing desirable features of ample light and floor space



General machine shop (A 8), which is used in connection with program of orientation

Springfield's Vocational Program

Three-year trade courses

Boys Airplane Mechanics
Automobile Mechanics
Cabinet Making
Commercial Art
Drafting
Electrical Work
Machine Shop Practice
Pattern Making
Printing
Radio
Sheet Metal Work
Welding

Girls Bakery
Beauty Culture
Dressmaking
Foods & Catering
Millinery & Novelty
Power Stitching

General, or short unit, courses

Boys Electrical Work
Machine Shop Operations
Printing
Wood Working

Girls Distributive Occupations
Homemaking
Multi Occupations
Office Practice
Scientific Laundry

Cooperative courses

Boys Machine-Tool Making
Drafting

were intended to serve greatly diversified groups. The minimum age of admission was fixed at fourteen but no maximum was established. These courses ranged in length from two days to two years, depending on the needs of the individuals enrolling. Enrollees were prepared as quickly as possible for jobs, and only such subjects as were a necessary part of the performing of the job were taught.

These general vocational courses served another purpose. For the enrollees who were too young to be placed in employment, they became orientation or exploratory courses. As a result, many of those who had an opportunity to rotate from one school shop to another were better able to make a final choice of a trade course on the basis of their own experience in orientation courses and on the advice of the various teachers who had become acquainted with their abilities.

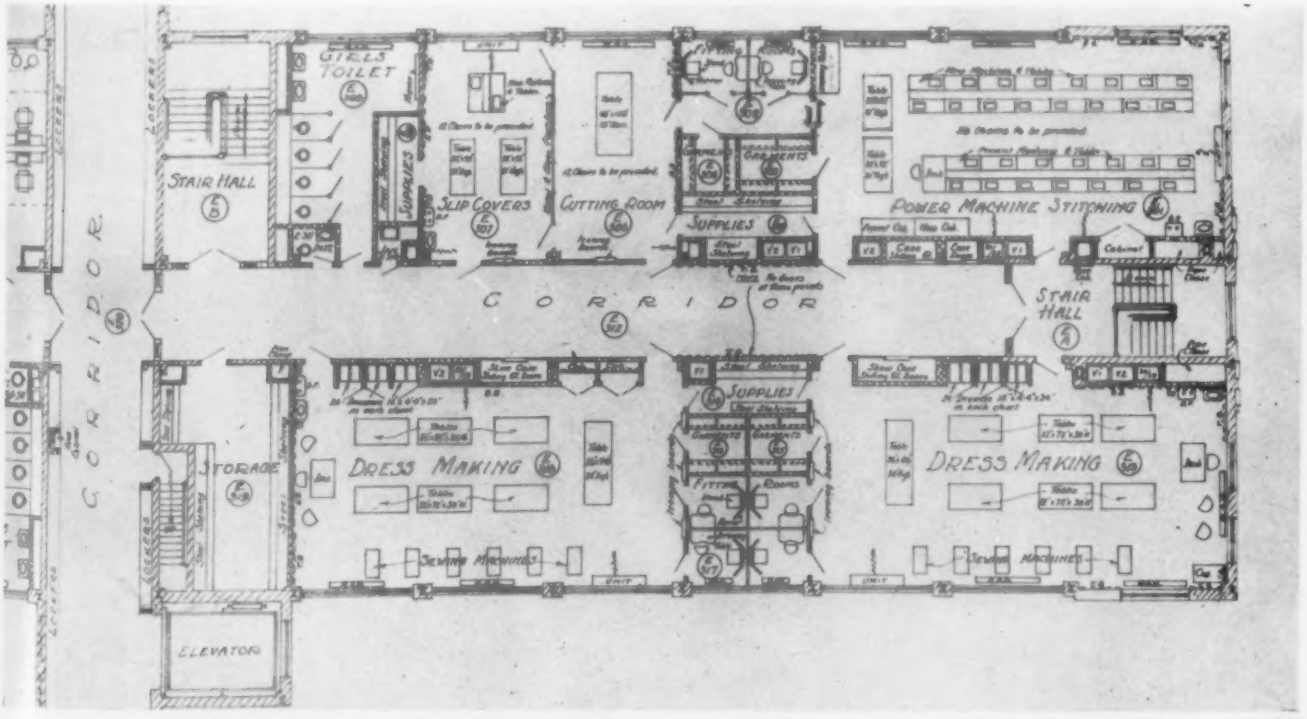
Other Schools Visited

While these studies were being made, trade and vocational schools located in the East and Midwest were visited in an effort to gather ideas on design and construction.

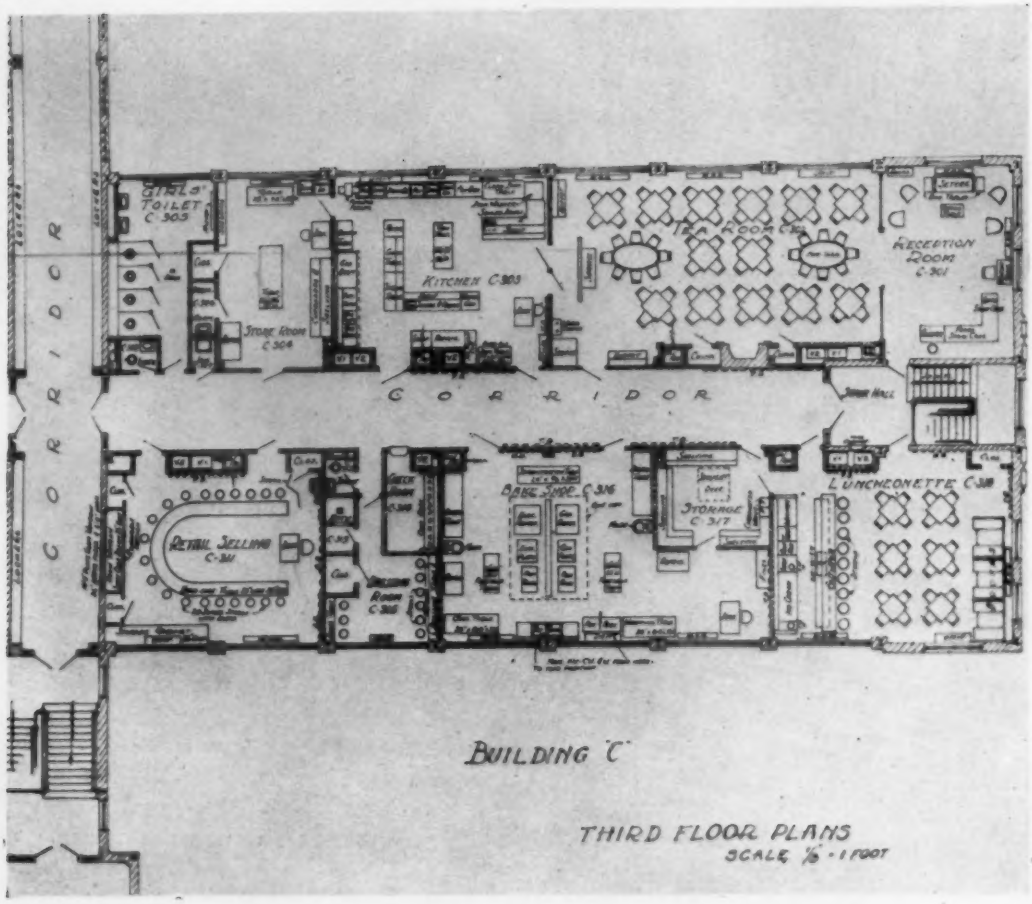
Four Separate Parallel Buildings

After the preliminary studies had been completed, it was decided to erect a building suitable to house a vocational program for Springfield and the towns in

Room (E 327) equipped with various types of power stitching machines. Opportunities for well-trained operators are numerous in the Springfield area



Building "E," third floor: A satisfactory arrangement for correlating needle trades taught in the school

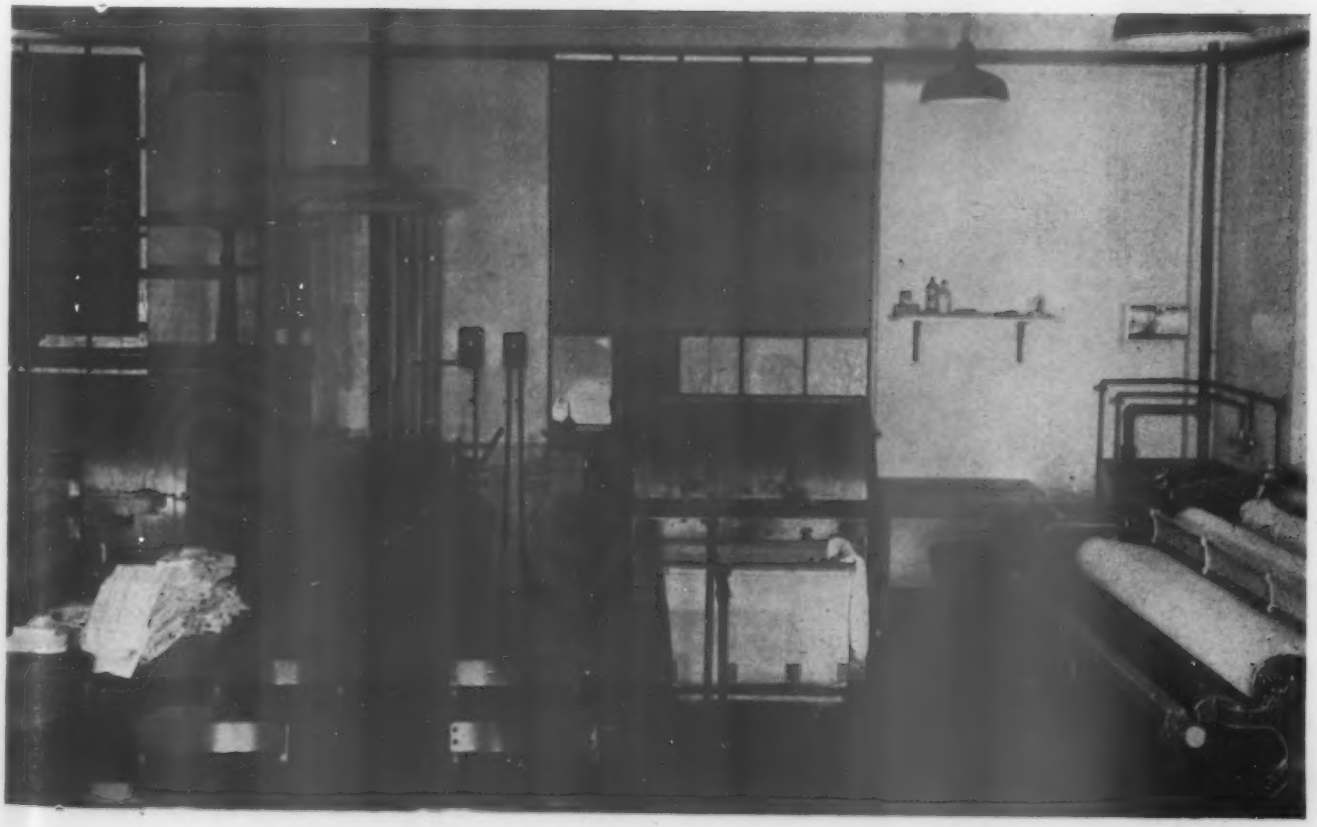


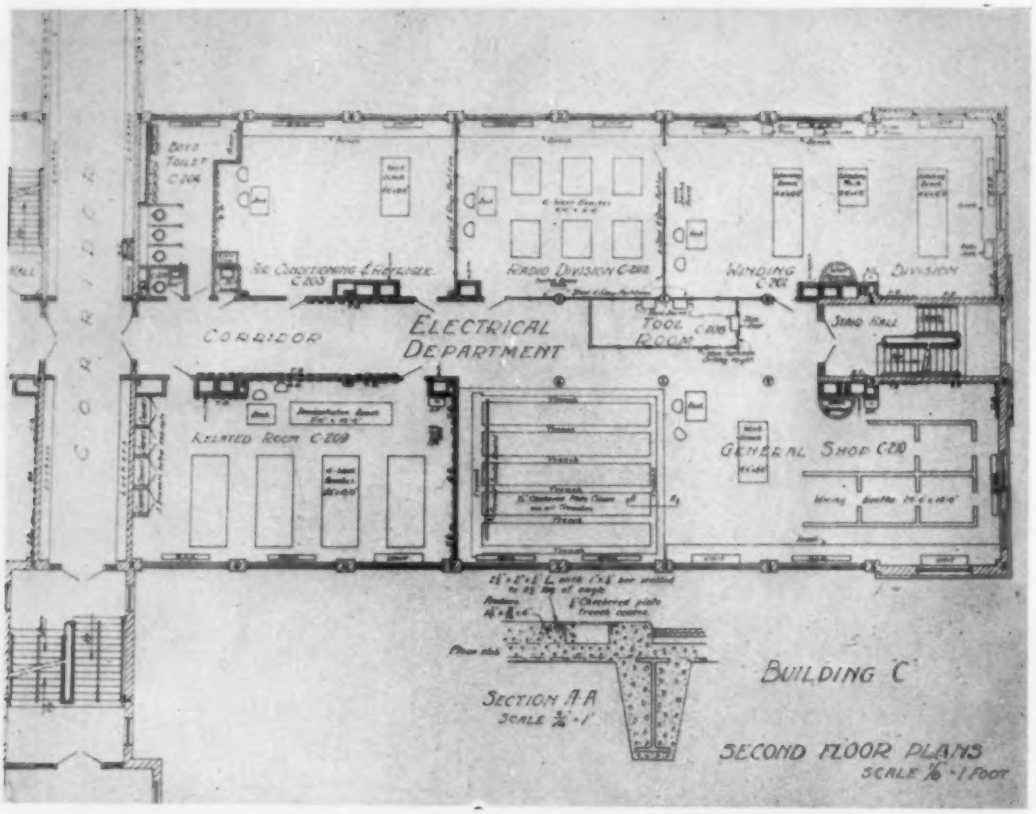
Left—Attention is directed to retail selling room (C 311); arrangement of the equipment was considered an innovation, but it has proved to be very efficient

Below—To this tea room (C 302) come citizens of Springfield and vicinity in groups of from forty to fifty. Luncheon is served to the public two days each week—Wednesdays and Thursdays

Right—All food served to tea room guests is prepared in this kitchen (C 318). Latest equipment is used

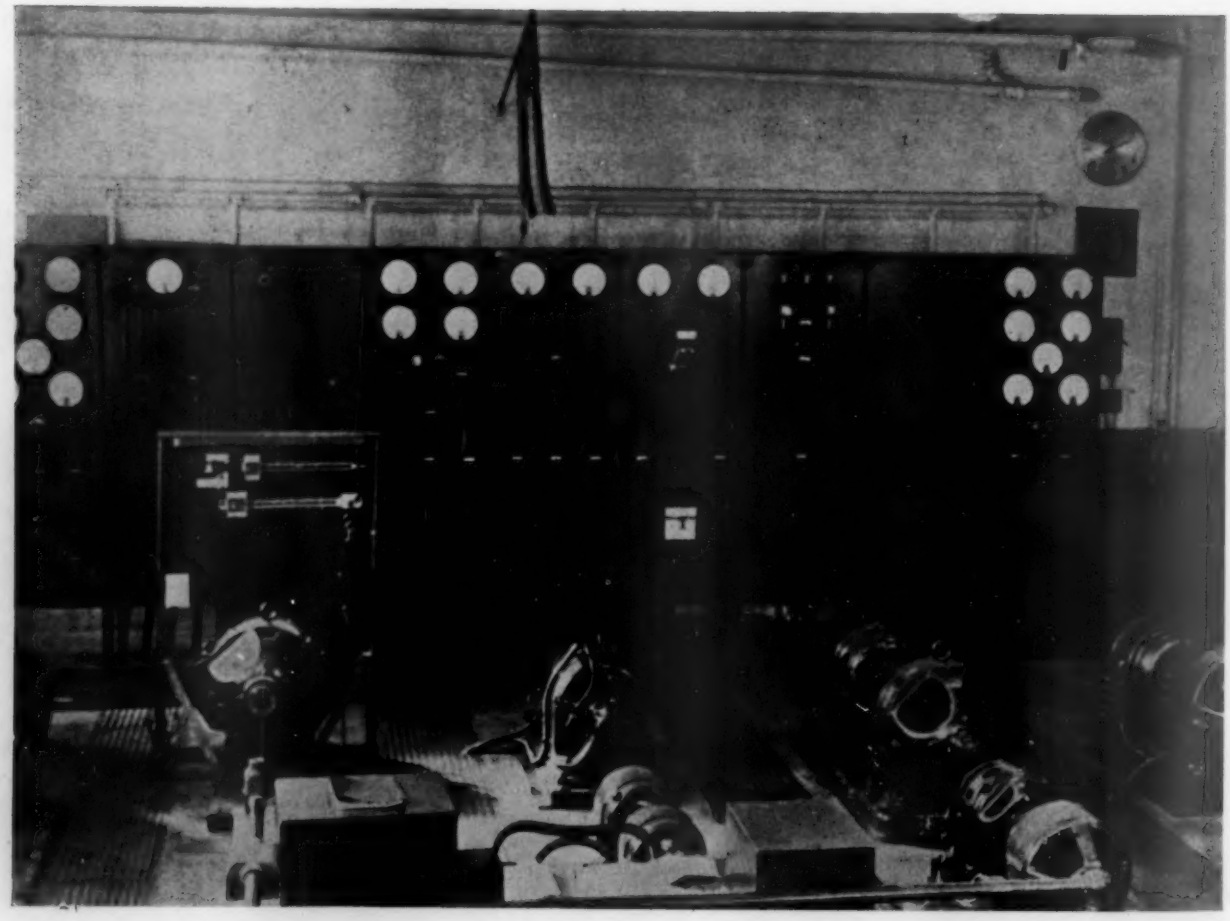
Below — In this well-equipped laundry (D 324), practically all of the school laundry is handled. Much work is done for other city schools as well

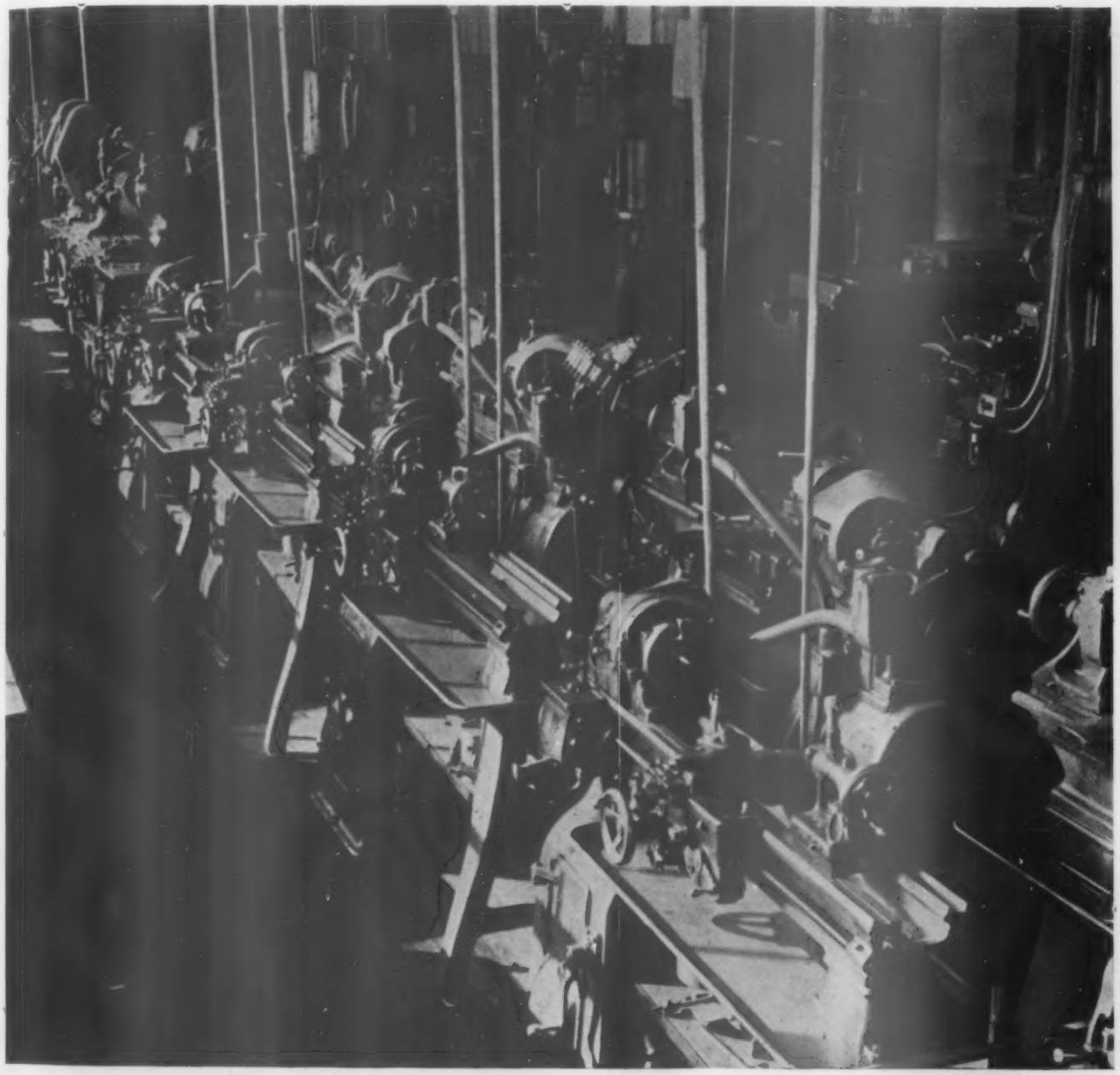




Left—Inability to secure materials and supplies made it necessary to discontinue temporarily the course in air-conditioning and refrigeration. To meet the increased demand for radio, particularly by the U. S. Signal Corps, the radio shop was enlarged by removing the metal partition between it and the refrigeration shop

Below—Motors are tested, repaired, and, when necessary, re-wound in this modern electrical shop (C 210)





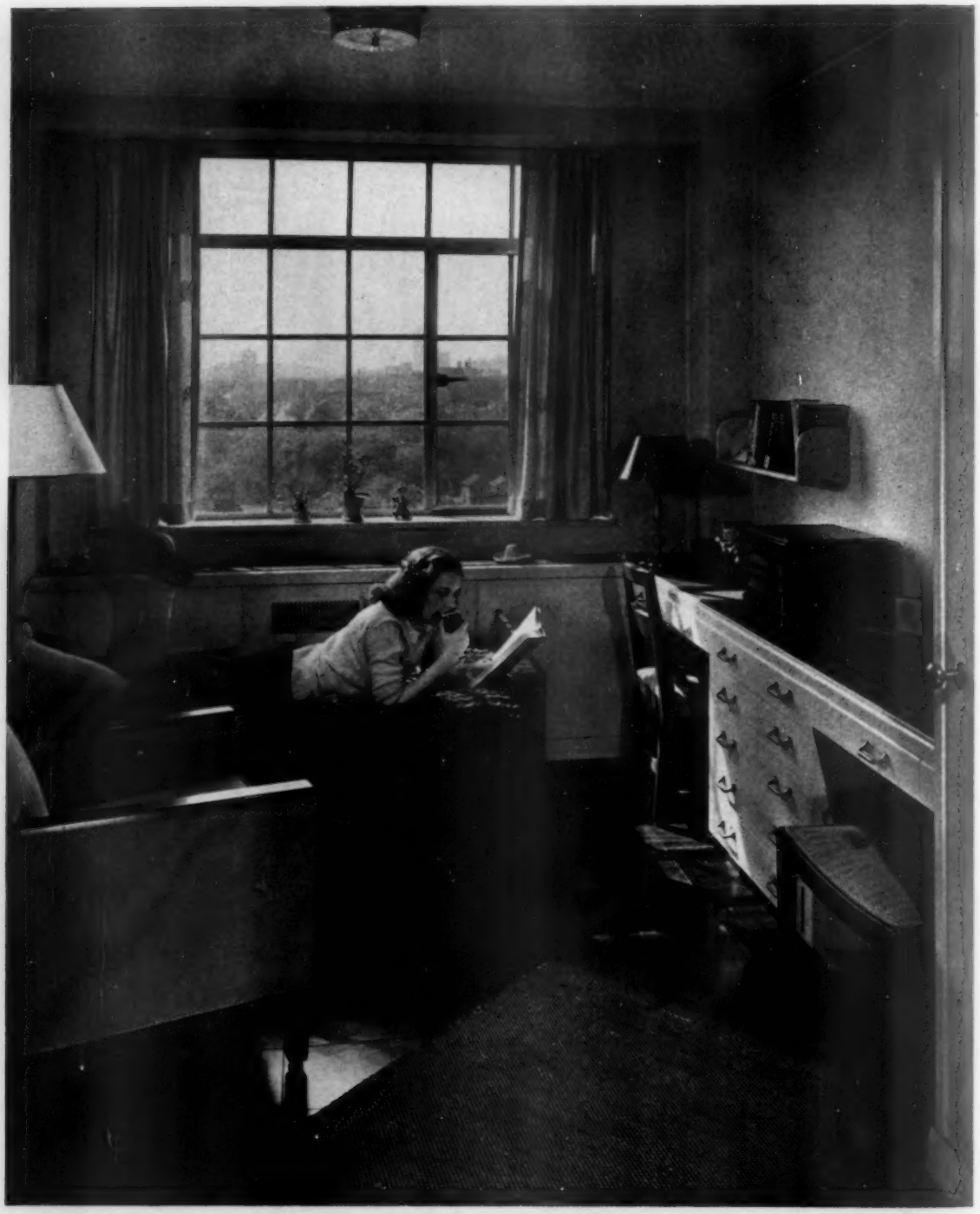
A modern machine shop (C 110), containing 99 machines of all types. Each machine is equipped with individual motor drive

the immediate vicinity, with an estimated maximum capacity of two thousand students. The ground was broken in the fall of 1938 and the building was occupied in September of 1940.

The school plant is in reality a group of four separate parallel buildings connected by cross-corridors on each floor. This plan provides for a maximum of light in all rooms. The front building in the group of four is considered the academic or "school" building. Corridors have tiled walls and terrazzo floors. It is a modern classroom building in every respect. On the other hand, the shops are located in actual shop buildings and are comparable in all respects to shops found in industrial plants. The partitions in these buildings are for the most part constructed of steel and are movable. In the short time the school has been occupied, this feature has proved its worth on several occasions.

Shortly after the building was occupied in 1940 a National Defense Training program was inaugurated. The urgency of this program made it necessary to modify and even to eliminate temporarily some of the regular trade courses and most of the general vocational courses. From September 1940 to December 1943, more than sixteen thousand adults were trained for local industries. This program has now subsided, and it was possible to re-establish the general vocational course at the beginning of this term.

The contribution that Springfield has been able to make to the war effort during these past three years is due in a large measure to the care and thought that had been put in the planning of the vocational program.



Before dinner, Comstock Hall, University of Minnesota

A human nature exists and operates in an environment and it is not in the environment as coins are in a box, but as plants in the sunlight and soil. It is of them, continuous with their energies, dependent of their support, capable of increase only as it utilizes them and as it gradually rebuilds from their crude indifference an environment genially civilized.—*John Dewey.*

THE MODERN COLLEGE DORMITORY, AN EDUCATIONAL ENTERPRISE

By LOWELL A. WRIGLEY

Superintendent, Baker Hall, The Ohio State University, Columbus, Ohio

COLLEGE men spend 80 per cent of their time in an environment other than the college classroom. While it has been granted for a good many years that an educated person must have a number of qualities in addition to having a thorough knowledge of subject matter which is largely gained in the classroom, yet our men students spend most of their time in sunlight and soil, in housing conditions, which may not give them the best opportunities for educational growth. The problem of the university is to plan, build, and make available to the students residence halls which have an atmosphere conducive to the development of mind, body, and character.

Bad Housing Gives Way to Good

Prior to the fall of 1940, the young men coming to The Ohio State University as students were faced with the prospect, probably for the first time, of living away from home. They had little to look forward to with respect to living accommodations. Some of them might live with friends, some in fraternity houses, but the greater number would be confronted with the problem of finding quarters in rooming houses in the university district. Because of unsatisfactory reports on the housing situation coming into the office of the dean of men, a director of men's housing was appointed. His responsibility was to check the so-called bad housing conditions, and to take steps to have them remedied.

By constantly making inspections, recommending improvements, removing the poorer arrangements from the lists, the office of the dean of men was able to give the young men coming to the university a much better chance than before to be satisfactorily housed. But that was all—a clean bed and a clean room. Unfortunately there were not enough of clean beds and clean rooms to go around. In the fall quarter of 1938, there were 4912 men students living in rooming houses in the immediate vicinity of the campus. The university administration was much concerned about the immediate situation and about the housing of future men students. The answer to all of this seemed to be the building of a residence hall for men. Surveys were made, meetings were held, money appropriated, contracts let, and in the fall of 1940 a new men's dormitory became reality.

Residence Hall Program Has Three Objectives

No longer were men students enrolled at the university confronted with a housing problem—not at least 550 of them who could be housed in Baker Hall. Large study rooms, pleasant dining halls, well-furnished lounges, and many other conveniences took care of that. But that was not enough. The administration had more in mind than just an up-to-date and comfortable home for college men. Personality development, group responsibility, social adjustment, discipline, and scholarship were comprehended for students living in Baker Hall. The administration realized that true education was an individual matter and that, regardless of size, the training and program offered had to be aimed at the individual student; that the whole individual was involved in this educational process and not just the intellect. Its sense of responsibility for the social, physical, civic, cultural, and religious development of residents, led to three objectives:

1. *To integrate all informal activities which tend to develop a "well-rounded educational program" and to suggest, initiate, and supervise methods for improving and expanding these activities.* The hope of the administration is to bring the quality of citizenship up to the point where the residents will conduct their affairs with responsibility, insight, and group spirit. By permitting and encouraging the residents to control their living in a small community, we feel that they will gain considerable experience in controlling their living in any community where democracy is the keynote. The average resident, by having a part in the government of the Hall, becomes more aware of his responsibilities to the Hall and to the other residents. He becomes more critical of his own behavior in his social situations.

With a view to giving each individual a chance to become a member of the Hall council, the dormitory was divided into sections. Each section elects representatives to the council, and the residents of the entire Hall elect the officers—president, secretary, and

treasurer. The council meets every other week to discuss the problems that have come up in the intervening period. Every resident is invited to attend the meeting and to speak if he has something pertinent to offer. Everyone is urged to vote and to participate in the social and athletic activities sponsored by the council.

Residents with journalistic skills, experiences, or ambitions may work on the Hall weekly newspaper. Those interested in athletics may participate in the complete intermural and intramural program. The residents with musical ability may express themselves as members of the Glee Club. Organizational ability may take root in innumerable activities of the dormitory self-government, the dances, the forum discussions, and the setting up and operation of a daily three-hour program of the Hall's own broadcasting station. Bridge lessons and tournaments, dancing classes, and open house festivities provide opportunities for making new friends, for wholesome entertainment, and for social adjustment. These many activities help the resident to realize his likes in concrete form. They provide companionship and refreshing activity.

Because many of the residents come from communities and homes in which wide social experience has been impossible, we know that we must assume responsibility for developing in these young men the poise and self-confidence that are properly expected of an educated person. We count upon participation in the activities of the Hall to accomplish this phase of our program.

Through these varied activities we know that the residents will learn habits of social conduct usually referred to as good manners. Through group life and cooperative enterprise, we hope the residents will learn to live, work, and play with their fellows on a basis of tolerance, unselfishness, and understanding. We have confidence that qualities of initiative, leadership, and self-respecting fellowship will emerge from these group functions.

2. *To assist the students in the solution of their personal problems. These problems may include questions of scholarship, moral behavior, and social development and, in the case of the freshman, initial adjustment to college life. Problems concerning health, finance, and guidance in choosing vocations are referred to the proper persons.* The transition is rather abrupt from the secondary school environment —where most students lived at home with parental discipline, advice, and supervision—to the university in which these elements of control are entirely lacking. This new environment quite naturally bewilders the average college freshman.

In addition to helping the residents with their personal problems, we are interested in scholastic achievements. Though grades are not always sound evidence of a true education, continued membership in the student body is, nevertheless, dependent on a satisfactory record. Since our contracts call for a full academic year residence in the Hall, we are more than mildly interested in seeing that all who begin the school year, barring sickness, lack of funds, or any other unforeseen difficulties, complete it.

3. *To improve campus morale and spirit, with the thought of upholding and fostering worthwhile campus traditions and indoctrinating the students with university loyalty.* To a large extent school spirit and morale will take care of themselves if the other parts of the program are successful. But it is necessary at all times to encourage group activities and point their direction in such a way as to carry over into events sponsored by the university.

Maintenance and Social Staff

No program with such a variety of aims and objectives can be carried out by one person. It is necessary to have the cooperation of the residence hall staff as well as that of the residents themselves.

The physical plant must be taken care of properly, in accordance with the standards of any commercial housing venture. Before the first resident arrives, the maintenance force, housekeeper, maids, and janitors, are given specific instructions on how to keep the Hall clean and comfortable. The main office is prepared to take care of the hundreds of details which crop up in connection with the operation of such an enterprise.

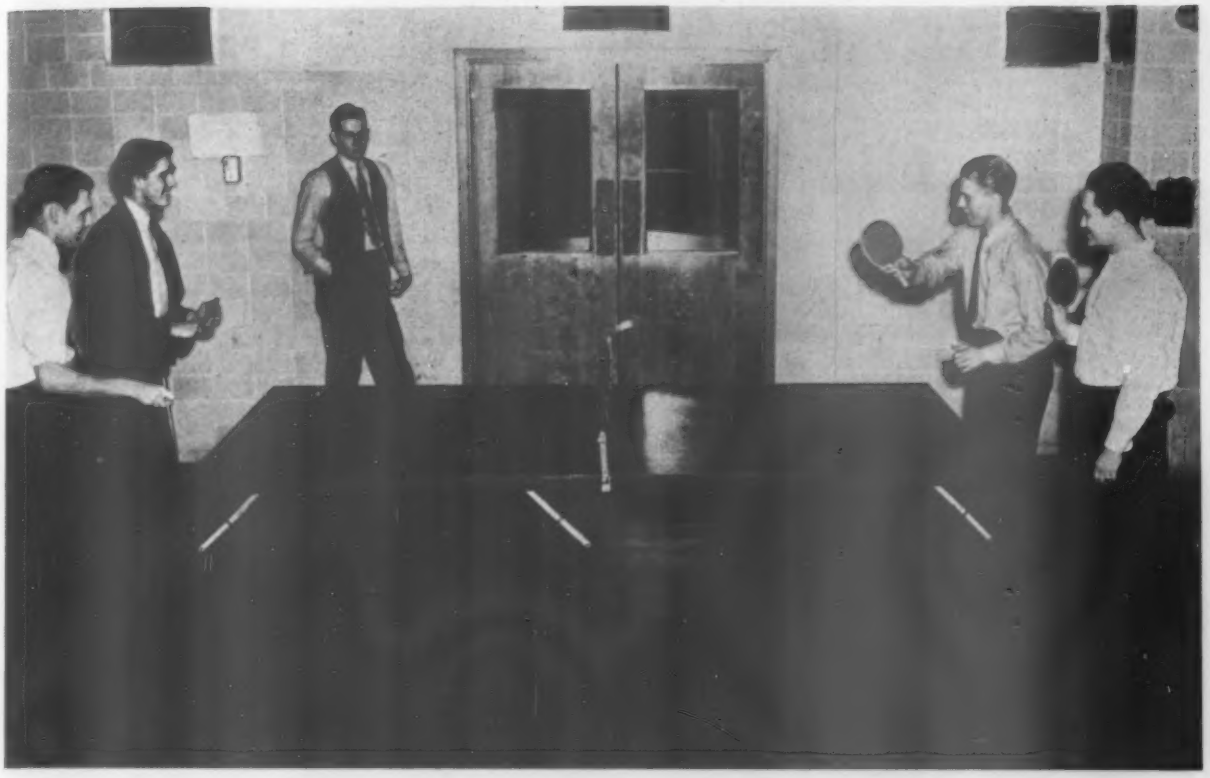
To help carry on the educational and social program of the residence hall, the staff includes a scholarship supervisor and proctors. The scholarship supervisor is a regular member of the teaching staff of the university. His duties are chiefly academic, but he is also expected to contribute some of his time and efforts toward making the Hall a better place to live from the standpoint of our three objectives.

The proctors, who are graduate students enrolled in the university and working towards advanced degrees, are selected not only because of their academic accomplishments, but also because of their demonstrated abilities in group leadership. They report at least a week in advance of the opening of school for a training period devoted to lectures, group meetings, and general instruction in the responsibilities of the work. These training sessions are carried on throughout the year, with talks by members of the faculty on psychology, health, education, and business. In addition, there are weekly meetings of the proctors when individual problems of residents are discussed. These meetings make it possible to develop a uniform policy with respect to those problems which prove to be general.

Personal contact is the basis of the entire proctor-resident program. It is the man-to-man discussion, characterized by frankness and mutual confidence, which produces results. The proctors are qualified to give good advice to the new men on personal matters because most of the little problems are fairly simple to an older graduate student who has had the benefit of at least four years of college experience. When the proctors are not able to help, they refer the student to someone more qualified, usually the junior deans of the colleges or the student medical bureau.

Students Enjoy Dormitory Competition

Many of the residents who were active in high school athletics are naturally interested in continuing with some of those activities, although not on a varsity level. For this reason the Intramural Department has worked out dormitory team competitions. The residents enjoy these contests both for the competition and the opportunity to get acquainted with



Baker Hall residents have many opportunities for "making new friends, for wholesome entertainment, and for social adjustment." It is hoped that these will develop the poise and self-confidence, the habits of social conduct, that are "properly expected of an educated person"

Scholarship is not forgotten, but emphasis is placed on cultivating all the qualities which enable a man "to live, work, and play with his fellows on a basis of mutual respect, self confidence, and tolerance"

Many of the activities of Baker Hall are, of course, repeated in other dormitories. Here are familiar scenes in the women's dormitory

An attractive sleeping room in Baker Hall

each other. The program is well worthwhile because it develops qualities of character, sportsmanship, and fair play; it has a subsidiary advantage in supplying an outlet away from the Hall for some of the excess energy which otherwise might be expended inside the dormitory during quiet hours.

Of course, all of that excess energy is not going to be expended on the outside. The residents, most of whom are underclassmen, play pranks on each other and have their fun. That is to be expected. Occasional roughhouses and disturbing incidents are bound to happen. But when these become the rule rather than the exception and go beyond the bounds of good taste, the students themselves usually take care of the situations either in their Hall council or by word of mouth. However, when the other methods fail, the problem is solved by the Hall staff, sometimes not to the complete satisfaction of the residents who are involved.

Good Scholarship Is Encouraged

Proper study conditions are maintained in the Hall during quiet hours, from 8 P.M. to 7 A.M.

Mid-quarter averages of the freshmen in the Hall are checked in order to find out who needs help. These averages, not grades as such and not recorded, are used entirely for the guidance of the students—to warn them of their actual standings at the moment and to give them information as to their strength or weaknesses. Establishing these makes it possible to direct students so that they will improve themselves.

Perhaps some of the readers of this article will think that too much emphasis is placed on extracurricular activities and not enough on scholarship. It may seem so, but actually it is not. In fact, scholarship plays an important part in all of the activities of the Hall. For example, all officers of the Hall council must make and maintain a creditable average; scholarship plaques are awarded to the section having the highest averages at the close of each quarter; residents, to be eligible for any of the merit awards at the close of the year, must have at least a C plus average; quiet hours are in effect and are enforced; proctors are available at all times for the assistance of any resident seeking their help; examinations and written reports are kept on file to be used by the residents for reference purposes in preparing for mid-terms and final examinations; instructors from different departments of the university are brought in to tutor groups in particular subjects.

But, despite emphasis on the necessity of study and success in the classroom, there is more to an education than "just book learning." The well-educated man must be able to get along in a social world. The program offered in a residence hall must involve all of those qualities which enable a man to live, work, and play with his fellows on a basis of mutual respect, self-confidence, and tolerance. The program should be interested in establishing good manners and proper behavior at social functions. Such a program, successfully carried out, can not fail to be an "educational enterprise" for the persons participating in it.

Quiet hour, Baker Hall

Taking notes, Stevens Mason Dormitory, Bucknell University

WHAT WE HAVE LEARNED ABOUT PLANNING FRATERNITY HOUSES—AN EVALUATION

By ALFRED T. GRANGER

Alfred T. Granger Associates, Architects and Engineers, Hanover, N. H.

THE influence of propinquity is constant throughout man's life. His environment molds his attitude of mind, and his method of living often determines his choice of action. Because a fine environment is of fundamental importance in creating a taste for fine achievement, it is essential that the surroundings and living conditions of students be of the best. Moreover, in my experience, it is noticeable that college boys like to be in pleasant surroundings, to have congenial roommates, and to be able to enjoy books and fraternal companionship. The college buildings which are loved the best, whether classroom buildings or fraternity houses, are those which have all the desirable environment of an intellectual life.. Architecture which seeks to achieve this quality must create human environment, stimulate imagination, and avoid crudity and monotony.

Architectural Possibilities

In planning and designing fraternity buildings, the first possibility is to create a permanent monument which will serve the needs of all fraternity members; the second, to erect a durable building which is flexible in use and to which additions can easily be made; the third, to design a building of modern materials with modern conceptions of simplicity, light, air, and freedom. Too formal or too picturesque reminders of our architectural past should be avoided. On the other hand, since the architect must design for both structural durability and flexibility of operation, the architectural expression must be more deeply rooted than the extremes of fashion that pass in the day.

The architect planning a fraternity house must once again be a fraternity member, inoculate himself with college life, and see what drastic changes have occurred since his scholastic days. Fundamental to the entire method of evaluation is the recognition that the same type of fraternity house will not fit equally well in all colleges. Although room sizes may be standardized, arrangements and requirements may be altogether different.

Dartmouth College Requirements

In the Town of Hanover, New Hampshire, where I am practicing architecture, Dartmouth College has wisely controlled its fraternity house requirements. The trustees insist that all the plans and location of a proposed new fraternity house have the approval of the trustees, and that the plans governing the administration of this policy be available to fraternities contemplating new construction. The trustees recorded its purpose as twofold: first, to protect the fraternities themselves by forestalling competition for elaborate quarters; second, to secure houses that will harmonize with the rest of the college plant and the Village of Hanover where the colonial type of architecture predominates. The requirements are:

1. That the number of students permitted to live in a house be limited to 16
2. That the buildings be of a residential type rather than a clubhouse type, usually with the main cornice line of the house at the top of the second story
3. That the house be of a good grade of construction but not elaborate or out of proportion with fraternity house building in recent years
4. That the total size be limited to 95,000 cubic feet figured on the outside dimensions, the height being computed from the basement floor to the average line of the roof and open porches not being included in this figure.
5. That the same limitations and approval be extended to and required for the enlargement of existing fraternity houses

Two Workable Plans

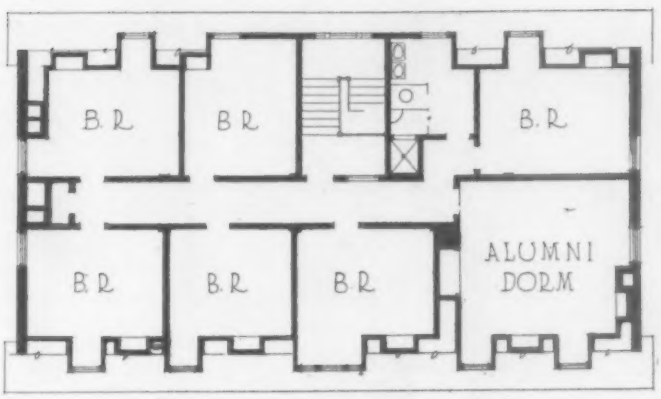
It is indeed a problem for an architect to work within 95,000 cubic feet and to include a large living room, card room, library, game room, chapter room, studies, proctor's room, bedrooms, toilets, etc. There are two plans meeting these fraternity house requirements that I find can be developed into workable and attractive buildings.

The most economical plan of operation is rectangular, like the Kappa Sigma house (see Figs. 1, 2, and 3). This building is fireproof, the outer walls being constructed of brick and terra cotta tile with reinforced concrete floor construction.

Not shown in the accompanying floor plans is the basement which has a large chapter room with modern ventilation, a large game room opening out to the grade in back, and an adjacent ski room for winter sport enthusiasts. The slate floors and pine walls of the game room are in keeping with the ski hut architecture.

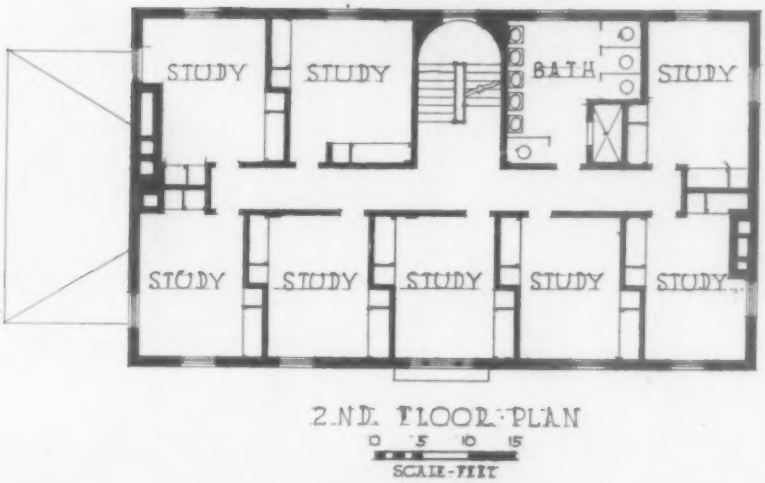
The living room, card room, and game room have knotty pine sheathing and paneled walls, while the remaining rooms throughout the house are plastered. Tile baths are essential and are found to be sanitary and most economical in the long run. The floor covering throughout, except in the living room and hall, is asphalt tile. The living room and hall flooring is oak on screeds.

The total cost of this structure was $48,788, which included $6,628 for heating and plumbing and $1,409



3 RD. FLOOR PLAN

Fig. 1. Kappa Sigma, third floor plan

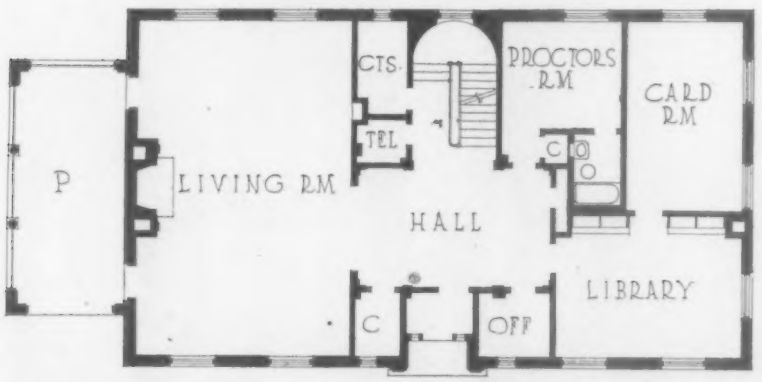


2 ND. FLOOR PLAN

Fig. 2. Kappa Sigma, second floor plan

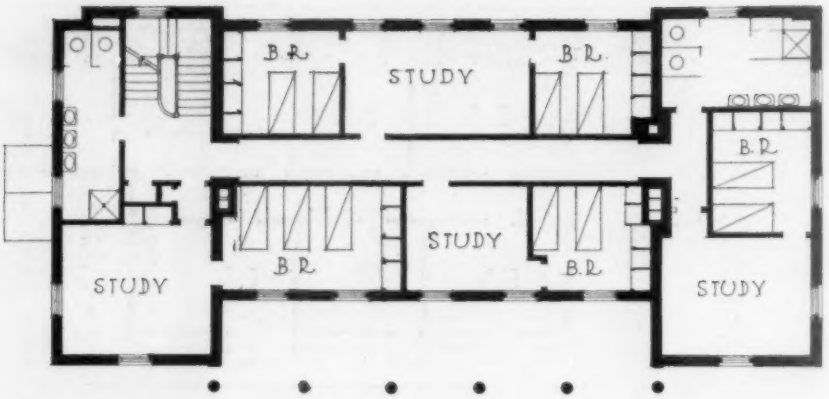
Kappa Sigma Fraternity House

The studies on the second floor are equipped with built-in wardrobes to serve as dressing rooms for the boys. On the third floor, there are four three-men bedrooms and two two-men bedrooms, plus the large alumni dormitory and toilet. To save fuel consumption, the only portions of the third floor that are heated are the alumni dormitory, the toilet, and the long corridor. The corridor gives off sufficient heat to warm the bedrooms



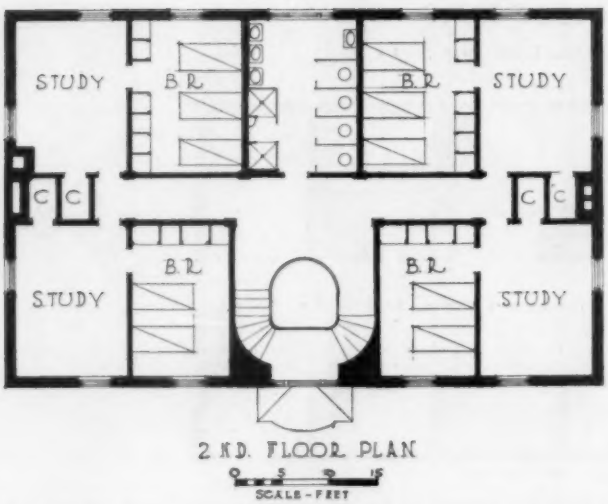
1 ST FLOOR PLAN

Fig. 3. Kappa Sigma, first floor plan



2 ND FLOOR PLAN

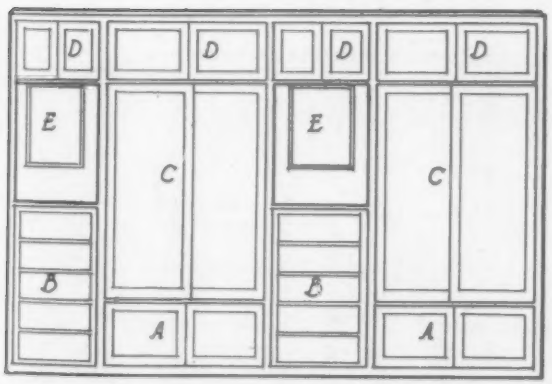
Above—Fig. 4. Beta Theta Pi, second floor plan. A very compact arrangement. The study in the rear accommodates four persons. Each of the two adjoining two-men bedrooms have two built-in wardrobes



Left—Fig. 5. Phi Gamma Delta, second floor plan. Three-men bedrooms adjoin two three-men studies; the other two bedrooms and studies are for two persons each

Beta Theta Pi Fraternity House

Kappa Sigma Fraternity House



ELEVATION OF TYPICAL WARDROBE

A · Cupboards
B · Drawers
C · Clothes Wardrobe with Sliding Doors
D · Hat Cupboards
E · Medicine Cabinets with Mirrors

The built-in wardrobe is an important feature of the fraternity houses discussed in this article. These units, which consist of mirror space, drawers, clothes closets, and hat cupboards, help conserve space by making it possible for the studies to double as dressing rooms. They also contribute to neatness and convenience in the bedrooms

for electric installation. This fraternity house was built in 1937 and 1938 and the total construction time was nine months.

Both the Beta Theta Pi and the Phi Gamma Delta are oblong-shaped buildings and have similar room arrangements, with studies and adjacent bedrooms on the second and third floors of each (see Figs. 4 and 5). The third floors of the Beta Theta Pi and Phi Gamma Delta have two-men studies and two-men bedrooms, with a large alumni dormitory to take care of visiting guests. The larger and less regular rooms depart from the standard arrangement of the second floor. The splayed walls of some of the dormers add to their attractiveness from the inside. There are adequate toilet facilities in both these layouts, and a satisfactory number of built-in wardrobes and cabinets.

Since the 95,000 cubic feet limitation makes it important to utilize the basement, both the Beta Theta Pi and the Phi Gamma Delta have large billiard rooms and chapter rooms. Each fraternity has worked out a distinctive design for their chapter rooms, which seat 50 or 60 boys. The rooms make use of indirect lighting and are planned to have ante and dressing rooms.

The fireproof Beta Theta Pi was built in 1933 when costs were extremely low. The total cost of $40,150 includes $4,638 for heating and plumbing and $831 for electric installations.

The Phi Gamma Delta, also fireproof, was built in 1937 and cost $41,986. This includes $6,758 for heat-

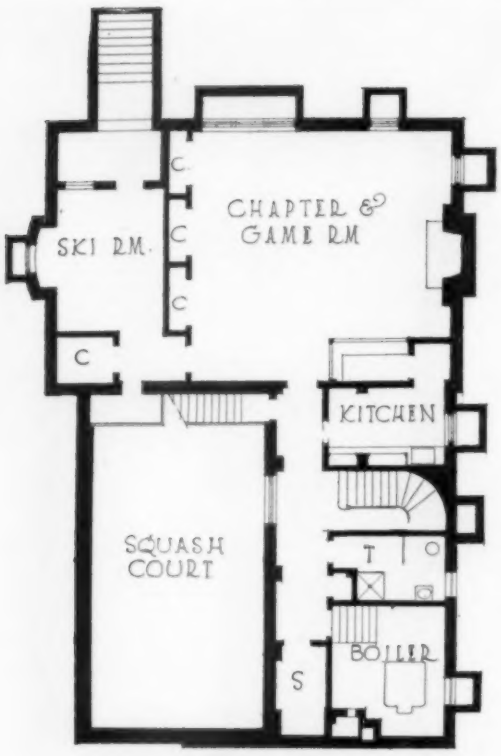
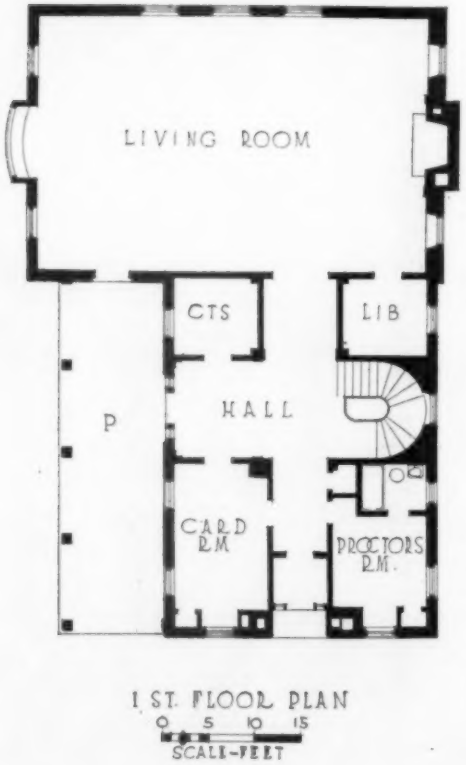


Fig. 6. Gamma Delta Chi, basement floor plan

Fig. 7. Gamma Delta Chi, first floor plan



ing and plumbing and $1,297 for electric work. Both these fraternity houses were completely furnished—with beds, tables, drapes, and living room, library, card room, and game room furniture—for approximately $6,300.

One of the most interesting fraternity house plans I have designed is the Gamma Delta Chi, a completely fireproof structure (see Figs. 6, 7, and 8). The studies on the second floor have built-in wardrobe units and are used as dressing rooms. The third floor bedrooms are directly heated. The floors, which are of concrete slab construction, are covered on the first floor with terrazzo, and on the second and third floors with asphalt tile. The toilets have ceramic tile floors and dadoes with built-in tile showers. The stairway, which is open and runs from the basement to the third floor, is of steel construction with precast terrazzo treads. The total cost of $56,557 includes $8,777 for heating and plumbing and $2,300 for electrical installations. This house was built in 1938 and took 11 months to construct.

House Should Express Character

It is my belief that the student needs the influence and environment of ideas of integrity, economy, liberalism, and good judgment, and it is for the architect to express these in his fraternity house planning. If the architect does not provide this environment for the student and presents instead buildings that are deceitful, extravagant, antiquarian, and tasteless, their influence on the student will be in accordance.

Gamma Delta Chi Fraternity House
Studies are on the second floor; bedrooms on the third

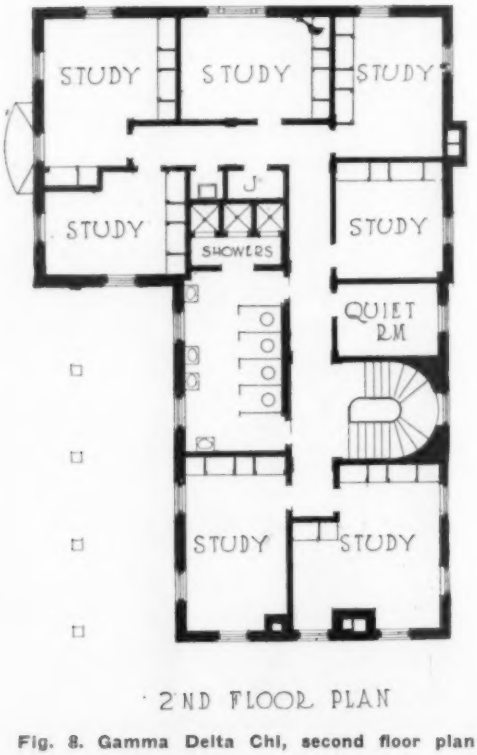


Fig. 8. Gamma Delta Chi, second floor plan

Linden McKinley Junior Senior High School, Columbus, Ohio. Looking towards one wing of the cafeteria-study room, showing soundproof folding doors which are folded back

PLANNING THE SCHOOL CAFETERIA FOR MULTIPLE USE

By EDWARD KROMER

Architect and Structural Engineer in Charge of Maintenance and New Construction,
Board of Education, Columbus, Ohio

IN the Columbus public school system during the last 25 years, the practice has been generally followed of designing the cafeteria so as to require multiple use of this unit for proper functioning of the complete school plant. The cafeteria dining room is made to serve the entire day by scheduling some classes in it for study purposes. The number of pupils reasonably accommodated in the cafeteria-study room increases the pupil capacity of the school by that amount.

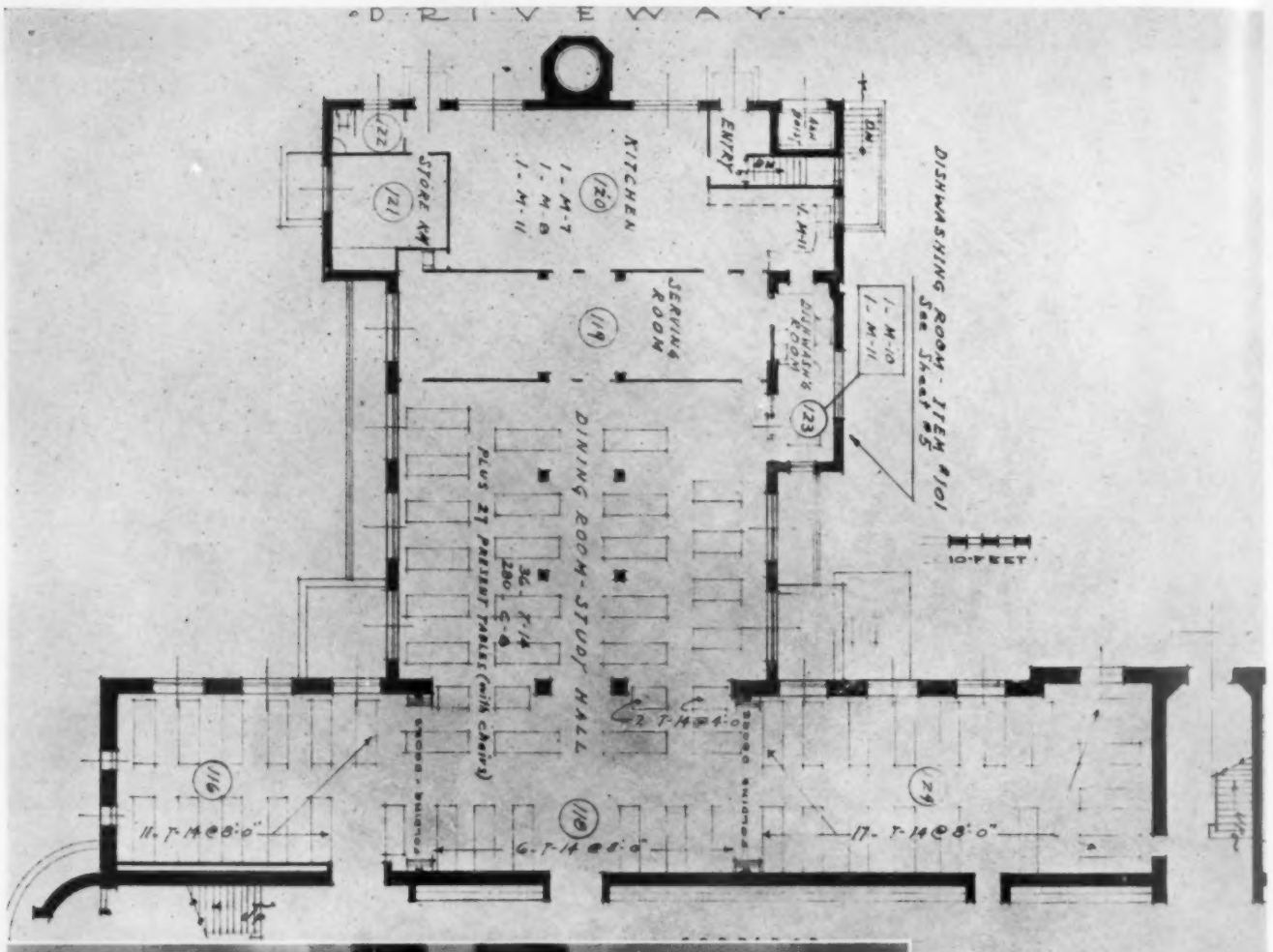
Chart Gives Principals' Views

Is the multiple-use cafeteria satisfactory? To supplement his own observations, the author, for years a part of the organization operating these rooms, consulted the principals in charge of seven multiple-use units. The composite result of this study, representing a combined experience of 84 man-years, is given in the chart on page 109.

For the superintendent or designer studying the practical aspects relating to feasible operation, the chart says quite clearly that the program of multiple use of this unit is satisfactory. For the designer interested in housing the greatest number of pupils for a fixed building fund, Item 18 answers his queries emphatically; the principals and the writer are unanimous in their judgment that the "multiple use of the room *is* a reasonable, economic procedure to follow."

Location and Layout

The preferable location for the cafeteria is on the first floor, overlooking pleasantly landscaped areas. The cafeteria should be located away from rooms such



Linden McKinley Junior Senior High School, Columbus, Ohio. Plan of cafeteria-study hall, service room, and kitchen (above), view of serving room (left). Folding soundproof doors across the wings increase the flexibility of the room—with doors closed the small rooms may be used as classrooms, small banquet rooms, or faculty dining rooms. Note the disposal and dish-washing room extending from the cafeteria room, where soiled dishes enter, to the kitchen. The kitchen is on the service driveway from where supplies are delivered

as shops, gymnasiums, and band practice and dramatic rooms, from which annoying sounds may issue.

The cafeteria in the Indianola Junior High School in Columbus is located on the top, or third, floor of the building, with an adjacent kitchen served by an elevator from the first floor. This location, which is a delightful one, has two serious handicaps: it necessitates elevator service to the kitchen and creates an additional maintenance problem due to position of the kitchen over finished rooms. We do not recommend this location.

The serving room, paralleling the cafeteria room at one end, should be long and relatively narrow. It should lead into a rectangular-shaped kitchen, which has mechanical equipment carefully laid out for efficient operation. Doors should separate the serving room from the cafeteria and the kitchen from the serving room. The kitchen should be served directly by the service door; wherever practicable it should be possible to unload directly from trucks into the kitchen storeroom.

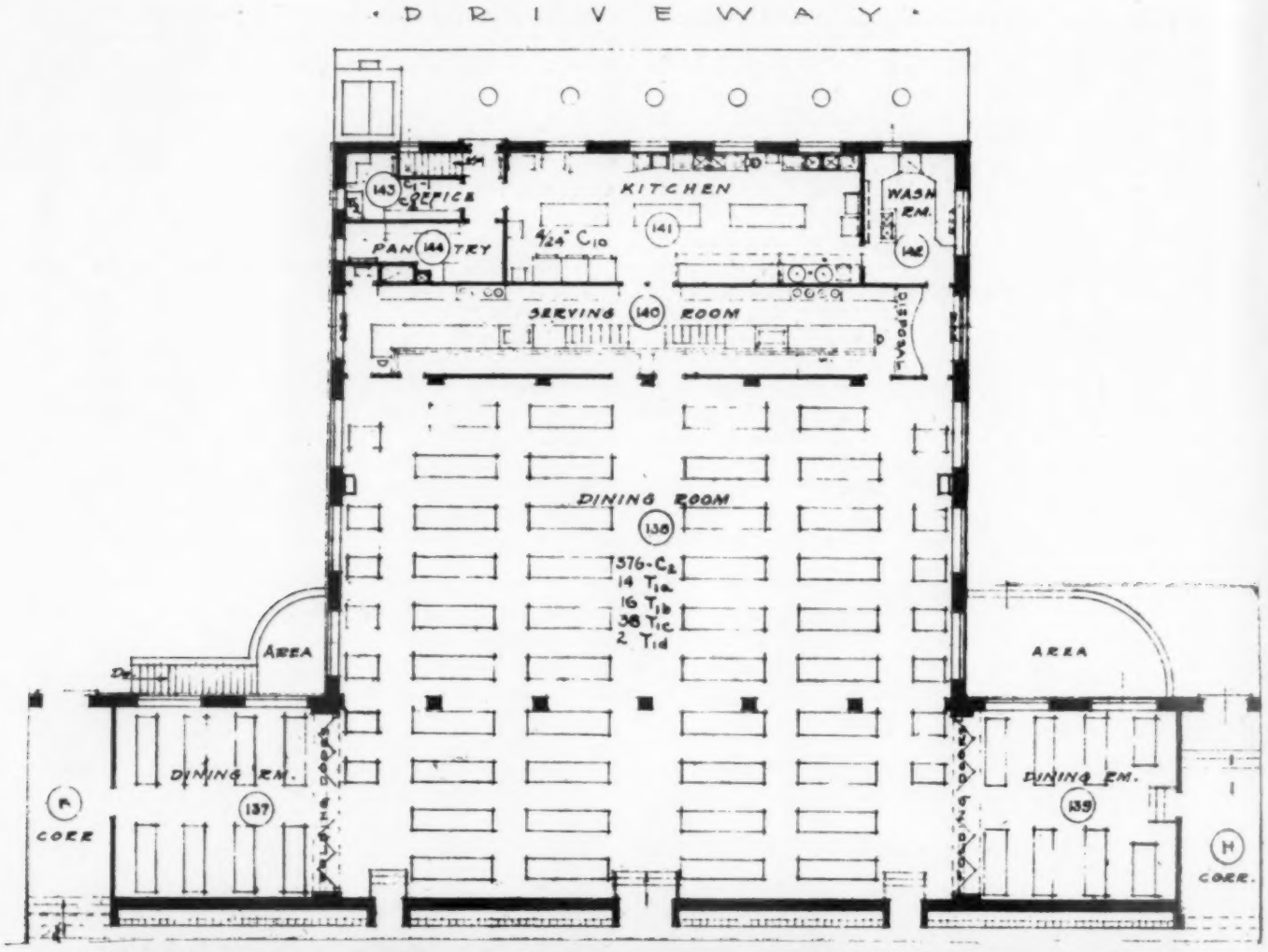
To speed up service, it is essential that two service lines be provided into the serving room and arrangements made for rapid disposal of soiled trays and dishes. A separate disposal room adjoining the cafeteria and kitchen has been found most satisfactory. Pupils carry their trays to the disposal windows, through which they pass them to be scraped, rinsed, set in racks, and passed to the dishwasher where they come out ready for re-use.

Interior Details

A partition, with doors which are kept closed except when food is being served, has been found essential between the cafeteria and serving room. The cafeteria should have a separate ventilating fan, exhausting generally through grilles in the doors to the kitchen, and from there through the hood, over the kettles and ranges, to the outside. An abundance of window area should be provided in outside walls. When the size of the room makes it difficult to get adequate natural light to the interior, ceiling lights under skylights should be provided. The ceiling of the room should have acoustical treatment if money permits. Ade-

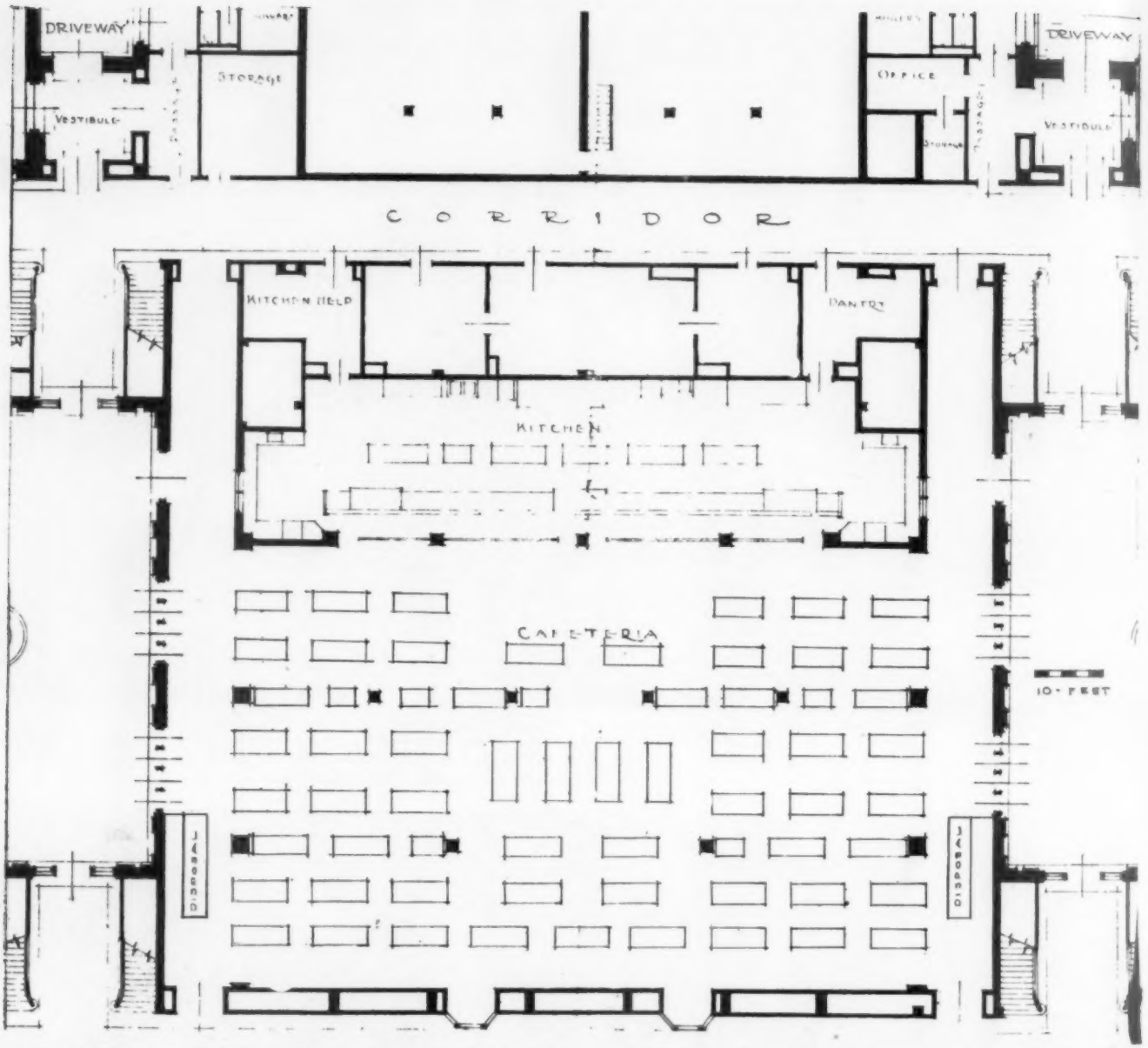
Chart Summarizing Experience of Principals with Multiple-Use Cafeteria

1. How many periods do you serve lunch?	Two periods in some schools, three periods in others.
2. How many periods do you use cafeteria for study?	Six periods generally.
3. How long is the "clean up" period?	One period generally.
4. What is the length of your period?	Forty to forty-five minutes.
5. Is administration as a study room more or less difficult than other study rooms?	Administration is somewhat more difficult than other study rooms.
6. To what uses, other than cafeteria and study, do you put the room?	School parties, football banquets, home room, outside organization meetings, P.T.A., social hour, club periods, bus riders' assembly before school opens.
7. Does the necessity for immediate clean up, preparatory for study hall use, present difficulties?	Where cafeterias are large no difficulty is experienced. Where cafeteria is small some slight crowding results during the clean up period.
8. Is the lighting satisfactory?	Yes (normal class room lighting).
9. Is ventilation satisfactory?	Yes (separate ventilating fans for cafeteria-kitchen have been provided).
10. Is flooring material satisfactory?	Yes (cement, terrazzo, mastic, linoleum. One floor of maple not recommended).
11. Do odors of food complicate the use of the room?	Generally no.
12. When used as a study hall do you use all chairs or every other one?	Some schools use all chairs. General practice is to use every other one.
13. Are chairs and tables more satisfactory than desks for study?	Generally speaking, fixed desks are preferred for study, but tables and chairs prove to be satisfactory.
14. Which tables are most satisfactory: solid wood tops or composition?	Some schools like composition. Generally solid wood are to be preferred because there is less cost in maintaining a smooth and sanitary surface.
15. Which type of chairs do you prefer: straight chairs or bentwood chairs?	Straight chairs generally preferred.
16. How many teachers and pupils are required to supervise the room?	Smaller cafeteria rooms, one teacher; larger rooms, two teachers; assisted by several pupils.
17. What other problems arise in the multiple use of these rooms?	Chairs should be equipped with rubber tips. Rooms should be treated acoustically.
18. Do you consider the multiple use of the room a reasonable economic procedure to follow?	Yes.
19. Do you have suggestions for improvement were we to build a new similar unit elsewhere?	Arrangement for closing off portion of room by means of folding doors is recommended. Always close off serving section from cafeteria-study room.



West Junior Senior High School, Columbus, Ohio. Layout of the cafeteria and view of the cafeteria-study room. Note folding doors across the wings. These add to the flexibility of the room. A partition with doors, which divides the serving room from the cafeteria-study room, cuts off odors and sounds coming from the kitchen. The disposal room connects the cafeteria to the dishwashing room adjacent to the kitchen. Supplies are delivered directly from the service driveway to the storeroom

Indianola Junior High School, Columbus, Ohio. Cafeteria-study room (above) and serving room (below). The cafeteria is located on the third floor. Service to the kitchen is by means of an elevator from the first floor driveway. The serving room is closed off from the dining room by a partition with doors which are opened when lunch is being served



Central High School, Columbus, Ohio. Layout of cafeteria-study room, kitchen, and related services. Although the supplies must be brought from the entrances across the corridor, the arrangement operates reasonably well. It is better, however, wherever practicable, to have the kitchen contiguous to the service driveway

quate artificial light should, of course, be provided for study purposes. Walls and ceiling should be light in color. Floor may be of any standard material except wood which presents a cleaning problem; flooring materials such as asphalt tile, mastics, linoleum, ceramic tile, terrazzo, magnesite are satisfactory, with preference for the more resilient because of their non-noise producing and acoustic qualities.

Tables may have linoleum tops, solid wood, or other equally hard tops. Preference here is for solid wood tops. With regard to chairs, low backs present a better appearance and are subject to less breakage than higher backs. Those we have used during the last six or eight years have backs only slightly higher than the tables themselves. Although bentwood chairs have the advantage of lightness in weight, they are not to be recommended because they suffer greater breakage than solid wood chairs—for it should be recorded here that the multiple use of the cafeteria puts a severe strain upon the equipment.

Testing milk

PLANNING THE BUILDING FOR A FOOD TRADES SCHOOL

By JACOB SIMONSON

Principal, Food Trades Vocational High School, New York, N. Y.

NEW YORK CITY has included construction of a Food Trades Vocational High School in its post-war plans. The new school, which has had the present food trades high school as a proving ground, will be an innovation not only in the type of training it will offer but also in the nature of the building and the arrangement of the classrooms.

Because the idea of preparing students to participate in the food industry is new, the question might be asked: What is the need for a food trades school in an American community? First, there is a labor shortage to which the cessation of immigration, the rapid growth of food industries, and the development of food science have all contributed. Second, the food industry employs more people than any other industry in the country and consequently offers long-term as well as immediate possibilities for absorption of trained personnel. Current war conditions, by aggravating the shortage of efficient labor, have emphasized the need for training workers.

Curriculum Based on Broad Concept

A determining factor in the building plans is a desire to equip the food trades students with more than mere manual skill. It is felt that those future citizens who will pass through the halls of the new school should have opportunity to acquire general education and culture in addition to specialized skills. This view was succinctly expressed by Mayor Fiorello LaGuardia in an address at the inauguration of the Apprentice Program in the present Food Trades Vocational High School, January, 1944. Mayor LaGuardia said:

> To-night you boys, seated in this small building cannot envision the new environment in which Food Trade students will study a decade hence, for we are moving into a new world. Do what we will, nothing can stop it. All of living and civic planning will be on a larger, grander, and more efficient scale. As soon as the war is over, New York City is planning to build the largest terminal market in the world—in all likelihood, several blocks south of where we are sitting now. Nothing like it has been seen anywhere. In the vicinity of that market—perhaps as part of the market itself—will be erected a new building for the Food Trades Vocational High School! That school will have enormous refrigerators, fine laboratories, kitchens of modern design (note I do not say cuisines). . . .
>
> But, it is not only the physical building which will be different in the new era. The curriculum will be different. No culinary expert will be regarded as an outstanding person in his field unless he has studied chemistry, bacteriology,

physics, animal anatomy and many of the other subjects which contribute to an intelligent comprehension of a master chef's job.

I can also envision that the new curriculum will emphasize the academic and the cultural—for make no mistake! The world into which we are moving tonight will encourage a high-level use of leisure time. When you have left behind the sickeningly sweet odor of boiling sugar and the cloying smell of burning fat, you will enjoy, and indeed long for, the concert hall, the theater, the museum and all those cultural activities which will lift you out of the kitchen and into the realm of the spirit. The day will soon pass when only a white collar will be the mark of ability to appreciate and enjoy the finer things of life. When you doff your white coat and your chef's hat, and mix with your fellow man, then will you fully comprehend that the vocational laboratory and the cultural pursuit must travel hand in hand.

The Building: Location, Design, Equipment

The first and most vital consideration for a food school is the site. Where should the building be located? The logical and plausible situation would be near a large terminal market or in the vicinity of the food distribution center of the particular town or city concerned because of the perishable nature of most foods, as well as the practicality of having the school near the industry it is designed to serve.

Facilities for the academic work should be part of the building plans, but the heart of the food school is the shop work. As far as possible, the conditions encountered in industry should be simulated in the shop classroom, even if on a reduced size scale. In general, we may say that shop construction should provide maximum safety precautions, modern sanitation equipment, and modern air conditioning units. Perhaps a brief description of the various shops and basic equipment which our experience has taught us are necessary would be helpful at this point.

A school with a student population of 2,000 should have the following shops to meet fully an adequate curriculum in food trades training.

Cafeteria
- A. Cafeteria and tea room—elementary cooking
- B. Cafeteria and tea room—advanced cooking
- C. Cafeteria and catering cooking
- D. Cafeteria and catering service

Meat Merchandising
- A. Meat cutting
- B. Meat packing and curing
- C. Meat and fish

Baking
- A. Bread shop retail
- B. Hotel baking
- C. Cake baking
- D. Bread—wholesale

Merchandising of Food Stuffs
- A. Food analyzing and sampling
- B. Food packing and cheese manufacturing
- C. Canning and bottling
- D. Window display

Hotel Trades
- A. Hotel cooking
- B. Hotel housekeeping
- C. Hotel service trades
- D. Hotel stewarding

Machine and Maintenance

Street Level Shops
- A. Cafeteria
- B. Bakery shop
- C. Butcher shop
- D. Grocery shop
- E. Luncheonette

The shops vary in size from 30x42 feet to 40x150 feet, depending upon the equipment installed for the different types of work. Ample working space is essential for practical reasons as well as for maximum safety. For example, the tearoom shop uses smaller

Skilled technique of cutting meat in conformity with butcher shop practice is taught in the second and third years

In kitchen of cafeteria and tearoom, students learn the art and science of cooking food in quantity

units than the meat merchandising shop, and space is proportioned to accommodate each type.

Let us examine in detail one of the cafeteria shops and one of the butcher shops to illustrate these differences. A brief outline of a typical baking shop and a food canning shop will round out the picture of the shops.

CAFETERIA AND TEA ROOM

Elementary Cooking

Size of Shop: 30 x 42

Number of Shops Needed: 2

Description of Activity: This shop is designed for elementary cooking instruction for girls. To be used in exploratory courses in cooking

Ceiling Height: 15 feet, hung ceiling, acoustic plaster

Walls: Tile to ceiling

Floor: Floor to be laid with sanitary floor brick, which is a highly vitrified, de-aired, vertical fiber unit, burned to a blue carbon manganese body from Canton clays. The surface is wire, cut to give an anti-skid surface. The hard-as-steel blue carbon manganese specially treated body and glazed surface will resist traffic and stand up when exposed to acids, brines, milk, blood, grease, and oils. They have long life and economy of upkeep as compared with practically any other floor material. The drain should be located in the center of the floor.

Color Scheme: One shop blue; one shop white

Equipment:

3 Work tables
1 Steamer
1 French fryer
1 Stove
1 Potato peeler
1 Floor mixer
1 Food cutter
2 Work benches
1 Bake oven
1 Sink
3 Bench mixers
1 Locker room
18 Electric hot plates
1 Refrigerator
1 Storage room

Special Note: Ventilating system and hood over stoves to be concealed by furred down walls.

MEAT CUTTING

Second and Third Year Shops

Size of Shop: 40 x 40, 2 Units

Number of Shops Needed: 4

Description of Activity: This shop to be used in instruction in meat cutting

Ceiling Height: Hung ceiling, acoustic plaster, 15 feet

Walls: Walls of this shop to be tiled to the ceiling with tile

Floor: Floor to be laid with 1¼ thick edge grain northern hard maple of the ironbound type, in second and better grade, laid in continuous strips.

Color Scheme: Pale green wall tile

Equipment:

1 Chromium display rail small hooks
1 Storage table
1 Work bench for tool maintenance and wrapping
8 Laminated cutting benches, provision for seats
1 Laminated instructors' cutting bench
1 Double size cutting block 4 x 2
8 2 x 2 cutting blocks
1 Stand and grinding machine
1 Stand and slicing machine
1 Combination sink and fountain
1 Raised platform scale
1 Tank for poultry storage in refrigerator
1 Tank for corned beef in refrigerator
1 Overhead trolley system with beam scale attached
1 Refrigerator
1 Locker room
1 Teacher's desk
1 Blackboard and corkboard
1 Material and tool storeroom

Special Note: These shops to be kept at a constant temperature of 55°

BAKING DEPARTMENT

Hotel Shops

Size of Shops: 60 x 40

Number of Shops Needed: 2

Description of Activity: General baking as being done in hotels. One shop for beginning students and one for the advanced.

Ceiling Height: 15 feet

Walls: Lower level, light brown tile. Upper level, old ivory colored brick tile or cement

Floor: Around equipment terra-cotta tile or cement with drains for proper drainage. The working area or center of the floor to be laid out in #2 oak flooring, iron-

Right — Many students take a lively interest in the grocery shop

Below — General baking according to hotel practice is taught in the hotel shop

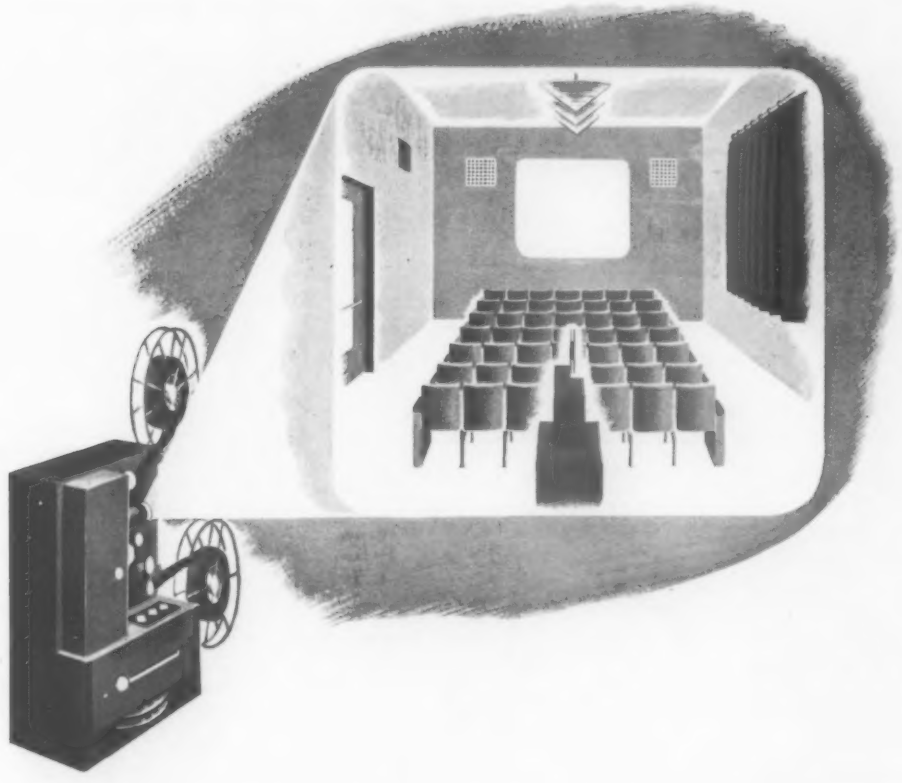
bound type. The board between the wooden floor and tile to be corked.
Color Scheme: Ceiling and upper level—Canary yellow
Windows: Glass brick
Equipment for Each Shop:
1 Pan closet—to meet specifications
2 Shelf ovens
1 Proof box
2 Sinks (large)
1 Pan drying unit
1 Frialator
4 20-quart mixers (bench style)
1 Gas stove
1 Steam kettle
2 Sinks (small)
8 Work benches
1 80-quart vertical mixer
2 Ice cream freezer units
2 Fudge warmer stoves (for 3 pots)
2 12-quart mixers, bench type
1 Demonstration bench

Special Note: Equipment for temperature and humidity control is to be installed in these shops. Ventilating system and hood to be concealed by furred down walls.

FOOD CANNING AND BOTTLING

Size of Shop: 30 x 42
Number of Shops Needed: 1
Description of Activity: This shop to be used for instruction in canning and bottling of fruits, vegetables, meat and fish products
Ceiling: 15 feet, acoustic plaster, hung ceiling
Floor: Sanitary floor brick with drain in center of room
Color Scheme: Rose tile
Equipment:
1 Locker room
2 Sinks
1 Filling machine
1 Pressure cooker
1 Labeling machine
1 Double capping machine
1 Refrigerator
1 Towel and supply room
2 Work tables
1 Exhaust box and double steamer
1 Cooler
1 Blanching machine
1 Pickling vat

We feel that the end of the war and the peace to follow will witness a tremendous development in education and that it is not too soon to plan facilities to meet this expansion. The cooperation of educators with industry in all its phases is the surest basis for the success of the programs which we hope will become a reality in the near future.



Courtesy of RCA Victor Div. Radio Corporation of America

DESIGNING THE SCHOOL BUILDING FOR EFFECTIVE USE OF AUDIO-VISUAL AIDS

By PAUL E. LONG

Division of Visual Education, School District of Philadelphia, Pa.

IT can safely be said that very little has been done in the original planning of our school buildings to encourage the most effective use of audio-visual aids. The present practice seems to be to make adaptations or alterations which at best are only makeshift. As a result, schools are far behind the standard set for professional projection and sound reproduction.

Although some fault may be found with the projection and sound equipment itself, far greater criticism must be made of building accommodations. Not all of us have learned that the modern classroom consists of more than walls, windows, and blackboards. Teachers will not employ audio-visual aids when results constantly are disappointing. Nor will they continue to be willing to have their classes and classrooms upset in order to utilize these aids. Too much time is used in merely setting up equipment.

The School Auditorium and Audio-Visual Aids

Construction emphasis has frequently made the auditorium the only area in the school where building plans have taken into account certain mechanical and acoustical needs. This is good enough to satisfy the requirements of modern assembly rooms, but it has not helped audio-visual education in the least. The fact of the matter is that it might be especially beneficial to take audio-visual education *out* of the school auditorium. At least, we would not be constantly emphasizing the wrong notion that the program is merely a supplement to the Saturday matinee.

Single Audio-Visual Aids Room Is Not Ideal

A single audio-visual aids room, appropriately equipped, is far better than the auditorium situation but is by no means ideal. It is no more natural for a group to leave its workshop, the classroom, to find an answer to a problem through the medium of an audio-visual aid than it would be for that same group to go into the hallway to read its textbooks.

To insure maximum effectiveness, the classroom of the future must be designed with the idea that these newer materials of instruction are as much a part of the setting as chalk and chalk racks. We can stop regarding them as toys, on the one hand, or materials beyond the comprehension of the teachers, on the other.

Adaptations Are Unattractive and Inefficient

The child who sits in the classroom of the future has almost a "constitutional right" to study in the most

attractive and *efficient* place school architects can plan. This should stop the practice of doing over classrooms to adapt them for use of audio-visual aids. Too many of us have seen strips of wood hinged to casements, so that when these strips are swung into place they will shut out the light escaping at the edge of inadequate shades. And at the same time, far too many classrooms still depend on a single electrical outlet not too advantageously located.

In new building construction, darkening facilities, electrical outlets, screens, and adequate methods of ventilation are primary considerations. It is not my intention to neglect these, but so much has been written of them in the past that by now they should have found their way into the commandments of building.

Equipment Can't Overcome Poor Sound Conditions

The advent of "sound" in schools poses a new and greater problem for school designers. In the past, except in special places in school buildings, we have allowed acoustics to take care of themselves. When sound conditions were difficult, we merely turned up the volume indicator and let it go at that. The distorted effects did not seem to bother us in the least. That too large a percentage of boys and girls had difficulty in hearing, or did not understand at all, seemed to be only of slight concern.

We listened to symphonies being reproduced poorly and expected boys and girls to sit enthralled. We blamed equipment and said that the day would come when the same equipment would be improved and things would be better. The day has not come, nor will it ever, until we start doing something about it before our building foundations are laid.

We carry portable radios, designed for home use, into classrooms and expect that they will be satisfactory. And we use transcriptions or record playing equipment with sound systems that are only slightly better.

Volume Levels Must Be Reproduced Accurately

An infinite variety of sounds may be encountered in the use of films, radios, or recordings. The human ear can distinguish one of these sounds from another only because of some slight variation in either the quality or intensity. If we are to record or reproduce sounds faithfully and effectively, the equipment and room conditions must be capable of reproducing accurately not only every minute change in quality, but also the full range of volume levels that the ear can hear.

When this sound is natural and realistic, the value of the particular film, transcription, or radio program is enhanced, but if the sound is harsh and unnatural, it becomes more irritating than educational.

Acoustical Settings Are Antiquated

Of prime importance then are the acoustical properties of the classroom. Sound easily may be reflected several times by improper wall or ceiling conditions. This persistence of sound can cause successive syllables to overlap, making the speech confusing and unintelligible. It is only when these successive syllables arrive at the listening children distinct and free from each other, that speech is easily understood.

Equipment manufacturers have tried to do their share by designing sound-reproducing equipment with ample reserve power so that reproduction may be obtained at a proper level without distortion. But this has been almost the end of the road. The improved methods of reproduction are still made to serve in the antiquated acoustical settings of the usual classroom.

Speaker Systems Left to Chance Placement

Speaker systems are duplicated with every audio-visual device we use. There is the four-inch cone for the portable radio, the six-inch speaker for the playback or record player, and again the independent system for our sound motion picture projector.

Practically all of these are left to chance placement. No really scientific medium is employed to determine the maximum effectiveness of their position in terms of the boys and girls who are expected to receive meaningful sounds from this equipment.

Sound Level Meters Show Up Deficiencies

Sound level meters have been designed that would provide a check for listening conditions, and on the basis of the acoustic response, adjustments may be made for proper sound quality for any speaker system. Response curves run at several points within the classroom, will show up quickly any deficiencies that may be present. Speakers then may be accurately angled on the basis of these readings to give a more efficient sound distribution.

This, of course, will entail a permanent set of adequate speakers in each classroom, or those particular classrooms designated for the use of visual-audio aids. For optimum satisfaction, they should be recessed in the walls and provisions made for them in original building plans. These same speakers, then, accurately angled, may be employed for all aids involving the use of sound. Careful planning in the purchase of projection, radio, and playback equipment will be necessary so that all of the equipment can be used with the same speakers.

The Classroom a Jack Built

A system of shielded wiring and jacks in the wall of the room will make it possible for the various aids to be used at several places within the classroom. A teacher will be able to plug in a radio or playback at the front or side of the room, whichever may be more convenient, and utilize the previously tested speaker system. The sound motion picture projector can be plugged into the jack provided for it in the back of the room.

With the considerable saving of the teacher's time through such a system, and the still more important factor, of the better production of sound, teachers may be encouraged to make more effective use of these instruments of instruction.

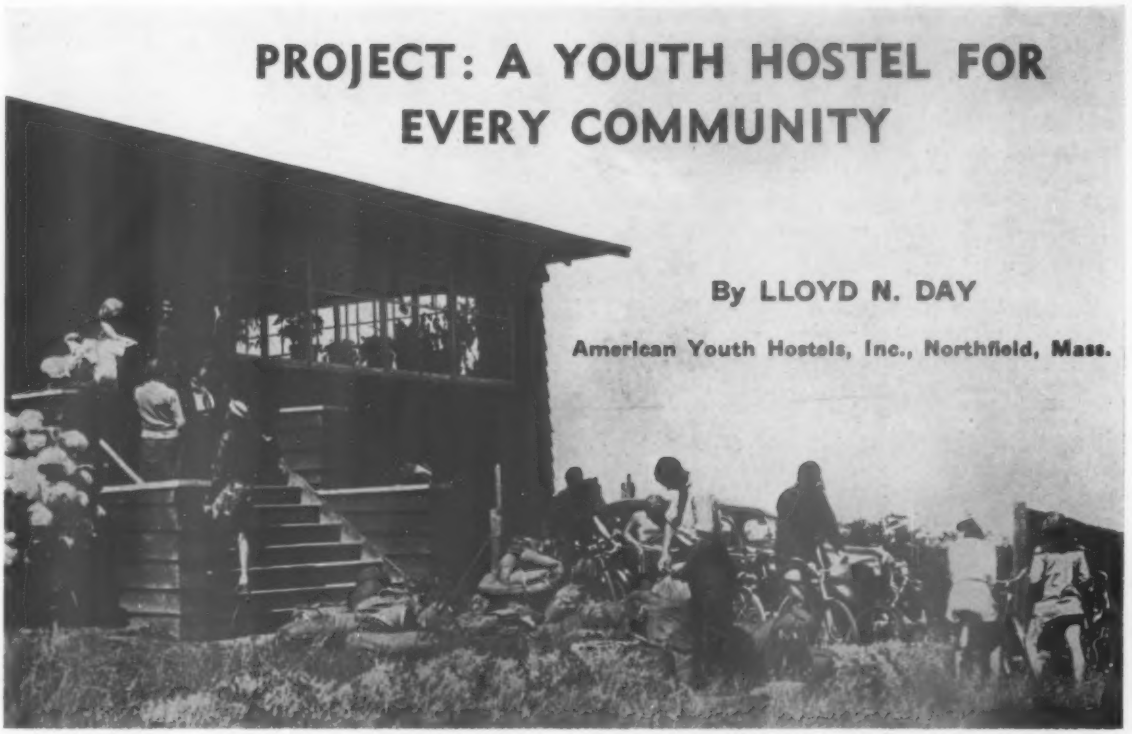
Sound Deserves a Planned Environment

Sound deserves a *planned environment* in the school of the future. Proper conditioning can be used to enhance and enrich its qualities. The scientific placement of reflecting and absorbing surfaces and speaker systems should add new clarity and resonance. But until we have achieved these things in our schools of the future, we must admit we have neglected to realize the full value of a potentially worthwhile medium of learning.

PROJECT: A YOUTH HOSTEL FOR EVERY COMMUNITY

By LLOYD N. DAY

American Youth Hostels, Inc., Northfield, Mass.



A California hostelers' group prepares to start the day's cycle

SOMETIME in your travels you may have come across a friendly-looking building, its entrance marked by a white triangle bearing the cryptic letters *AYH*. And very likely—unless you are one of the 15,000 regularly enrolled members of American Youth Hostels, Inc.—you passed it by without a second thought.

But to a hosteler, defined as "one who travels under his own steam," that sign says many things. It indicates a place to break his journey, a haven where he will find kindred spirits who share his love for the outdoors, a wholesome rendezvous of song and laughter.

Today in the United States there are 252 chartered youth hostels like this one. They are to be found in eight [1] sections of the country, and in ten years they have provided overnight accommodations for 101,346 American youth—for a total of a quarter million "overnights."

Though hosteling has come a long way since its introduction to this country in 1934-1935, there is much to be done before it becomes "so common a heritage that no village, town, or city shall fail to open its welcoming youth hostel door to our youth and the youth of the world."

Beginnings of Hosteling

Before discussing how this can be accomplished, it may be well to review briefly the story of hosteling. In the summer of 1933 a few young Americans, traveling in Europe, were enchanted with the simple, inexpensive overnight accommodations open to them in countries from Norway to the Mediterranean. From his own lips, they heard how a young school teacher had pioneered by taking his pupils on weekend trips; how he had seen listless youngsters return from days spent in the open shiny-eyed and happy, with shyness and unfriendliness dropped on the way.

To extend these benefits, he conceived the idea of hostels: "inns where youth was king, ringing to youth's laughter, costing so little that all could be off on the magic trail." The first such inn was opened in 1910 in a school not in use in the summer months. Teachers and lovers of youth in other countries were quick to take up the program. At the outbreak of the war in 1939 there were 5000 hostels operating in twenty countries, capable of taking care of a million youngsters a night.

Having visited many a European hostel, the Americans returned home, determined to start hostels of their own. Their first was opened in Northfield, Massachusetts, during the Christmas holidays of 1934. Of luxury there was a minimum—just a few dormitory bunks and a roaring fire. Though advisers had told Monroe and Isabel Smith, co-founders of the organization, that young Americans were too "soft" and "sophisticated" for this sort of life, they were visited by 250 hostelers that first week. Encouraged, they opened 34 additional hostels in a New England loop during 1935. Thus began American hosteling, which now has spread to 31 states of the Union.

Strictly speaking, hosteling is a "facility" and not a movement. In no way is it competitive with other youth organizations; it complements rather than duplicates their services. Thus, very often Boy Scouts or Girl Scouts travel the hostel trail as groups, under

[1] AYH divides the country regionally as follows: New England; Middle Atlantic; Southeast; Great Lakes; Midwest; Rocky Mountains; Northwest; Southwest.

supervision of their own leaders. Hosteling, then, offers all youth, organized or alone, a safe, pleasant way of seeing the country at trifling cost. Recognizing the value of hosteling, officers of 23 [2] youth organizations are coöperating by serving on the national board of American Youth Hostels, Inc.

Sociologists and others find in hosteling one of the finest means of youth recreation. Hosteling provides release and escape from congested surroundings, confining routine, and subjective restraint—to the broadening simplicity of the outdoors, the joys of discovery and adventure in new places. Hosteling offers the satisfaction of making one's own way and subtly develops the qualities of self-restraint, discipline, and consideration of others.

"Hotels" versus "Hostels"

Though between the words "hotel" and "hostel" there is a difference of but one letter, in actuality the two are quite dissimilar. In a hotel one pays for and—in normal times—has a right to expect service. In a youth hostel, the lodging bill is tiny: 25¢ a night, plus a fuel charge of 10¢ or 15¢, and the only service is that provided by the hosteler himself. He cooks his own meals, individually or with the group, makes his own bed, does his own housecleaning. All expenses for a day's travel, including lodging and meals, generally figure out to something under a dollar a day.

For admission to hostels, the only requirements are a membership pass and a sheet sleeping sack. The hostel itself provides beds, blankets, and cooking equipment, so the traveler need carry no more than ten pounds of "baggage," slung from his bicycle or in a knapsack on his shoulders.

The price of a membership pass is equally reasonable. For hostelers under 21 it is $1.50 a year; for those 21 or over it is $2.50. Also available from Northfield, Massachusetts, headquarters are group passes permitting organizations of up to ten members to enjoy the privileges of hosteling for $5.00 (if no more than two members are over 21) or $10 (where all members are adults).

Hostels as Links in a Chain

The problem of starting a new hostel is best approached by considering it as a link in a chain, for the main purpose of hosteling is to encourage traveling between units. Each new hostel should be established within convenient reach of the next one by bicycle or on foot; the optimum is an arrangement that sets them from 10 or 15 to no more than 35 miles apart.

The proximity of the proposed chain to a large city will be an important consideration in deciding on the size of the units in it. Also important is the matter of access by railroad or bus, for under the rules of the hosteling game it is permissible to travel to the starting point by public conveyance.

Hostels are most successful when they are located in a region of natural or historic interest which has an appeal, first to young people within the region, and second to people who will wish to visit it. National,

[2] Amateur Bicycle League of America, American Association for Health, Physical Education and Recreation, American Association of University Women, American Education Fellowship, Athletic Federation of College Women, Boy Scouts of America, Inc., Camp Fire Girls, Inc., Catholic Youth Organization of America, Coöperative League of the United States, Four-H Clubs of America, Girl Scouts of America, Inc., Institute of International Education, National Association for Advancement of Colored People, National Committee Boys' and Girls' Club Work, National Conference of Christians and Jews, Inc., National Education Association, National Jewish Welfare Board, National Popular Government League, National Preparatory School Committee, Rotary International, World Alliance for International Fellowship Through the Churches, Young Men's Christian Association, Young Women's Christian Association.

Rustic fireplaces along the trail make a hosteler's life a merry one

12

Above—This inexpensive hostel provides a recreation-dining room and kitchen in the main building. Sleeping facilities are in separate bunkhouses. Quarters for supervising houseparents are included in the plan

Right—". . . the hostel may be part of an existing farmhouse, with separate sleeping quarters partitioned off for boys and girls (the boys are frequently assigned to a barn or outbuilding)"

state or county parks, national or state forests and preserves, or recreational areas, all offer possibilities as youth hostel locations.

It is important that hostels be placed on secondary roads, where bicycle riding and walking are not dangerous. On the route, it is always good to provide rest shelters with approved water and sanitary facilities, and perhaps areas for picnicking or cooking. These may be of the simplest nature, in harmony with the natural scenery of the area. They are not absolutely necessary but are suggested merely as a means for providing rest and refreshment and as an added safety measure en route.

Individual hostels may be as simple or as elaborate as one cares to make them. Starting with minimum requirements, the hostel may be a part of an existing farmhouse, with separate sleeping quarters partitioned off for boys and girls (the boys are frequently assigned to a barn or outbuilding). Also needed is a place for cooking—perhaps in a corner of the farm kitchen—and a common room where hostelers can enjoy social life in the evenings. The farmer and his wife remain in charge as houseparents in their own quarters.

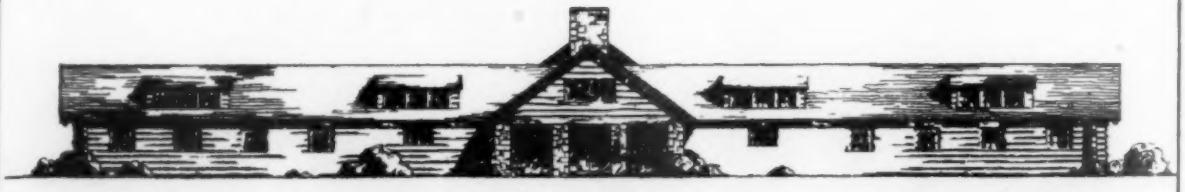
Slightly more elaborate is the plan which provides sizable recreation room, kitchen, and houseparents' quarters in an attractive main building, with bunkhouses and sanitary facilities located in separate outlying buildings.

Either of these arrangements is satisfactory where a community can afford no more, or where travel is light. A plan prepared by the National Park Service suggests that a primary hostel be somewhat more pretentious. The Park Service arrangement calls for a building of native materials, low and unobtrusive in character, in harmony with surrounding scenery. It would have a large common room, separate dormitories with 30 beds for boys, 30 for girls, and overflow space for 60 additional guests on the second floor. A large cooking room, also used for dining, would be located adjacent to a room set aside as a commissary. Adequate quarters for houseparents would be provided. Optional are a laundry room and a large common terrace for outdoor dining and group gatherings.

Without knowing the requirements or resources of a community, it is difficult to recommend a particular plan or to estimate building costs. However, the best hostels are not necessarily the most expensive, and hostels to accommodate 10 to 30 boys and girls can

SIDE ELEVATION

PLAN



FRONT ELEVATION

STUDY FOR A YOUTH HOSTEL

SCALE 1 0 1 2 3 4

Courtesy of U.S. Park Service, Department of the Interior

Plan for a primary youth hostel accommodating 30 boys and 30 girls on first floor, with provision for additional guests on second floor. Note that separate kitchen, bath, living room, and bedrooms are provided for houseparents

A typical trim New England farmhouse is the youth hostel at Jeffersonville, Vermont

Talking Pine Mountain Camp hostel is a friendly spot in the High Sierras near Colfax, California

be erected economically by employing materials at hand and local or contributed labor.

For communities with small budgets, there are possibilities in abandoned CCC camps; school buildings whose students have left them for union schools; empty churches; empty mills; and even railroad stations that have heard their last whistle.

Furnishing the Hostel

In fitting out the hostel, simplicity is the first order, for the facility is intended only for night time use. Wooden benches and tables are better than overstuffed pieces, and easier for the hostelers to keep neat. Beds should not be so soft as to encourage oversleeping. The best sleeping arrangement has been found to be bunks, double- or triple-decked. These can be purchased ready-made or constructed as part of a manual training project: uprights are fashioned of 3x3-inch pine, with ¾-inch pine for ends, sides, and bottom slats. Satisfactory mattresses may be made of ticking well stuffed with rice straw.

There should be a sufficient number of gas plates or stoves to prevent long waits for meals, and groceries should be available in the hostel or nearby. Naturally, there must be a tested water supply for drinking, cooking, and washing needs, as well as adequate sewage disposal facilities.

A pingpong table and a phonograph with square dancing records add much to the livability of a hostel, and suitable outdoor games are always appreciated. Facilities for ice skating, skiing, and tobogganing are other possibilities; if they are provided, some arrangement must be made for heating the hostel for winter use.

In some regions it may be feasible for hostelers to travel by canoe, faltboat, or horseback; if this is the case, the hostel committee may also wish to make provision for docks or stables. In any event there should

be a bicycle stand or shed, and materials for simple repairs.

Customs of the Hostels

There are no hard and fast rules in hosteling. The customs and traditions are based on thoughtfulness of others and consideration of the group. Most hostelers hike or ride distances short enough each day to give them time to stop and swim, to explore side trails, to investigate livelihoods typical of the area, to talk to farmers and villagers.

Usually they inform the houseparents of their coming in advance, and they are expected to check in before nightfall. There is no smoking or drinking in the hostels. Recreation is spontaneously initiated by the young people; square dancing, group singing, and exchange of experiences are the most popular evening activities. The retiring hour is ten o'clock; the rising hour is six, and all are on their way before nine. Except under unusual circumstances, no hosteler may stay more than three nights in the same hostel.

Upon arrival, the hosteler deposits his AYH pass with the houseparents, who are privileged to withhold it if the bearer does not live up to the few necessary regulations. But because hosteling is selective by its very nature—appealing only to those who have a sincere desire to travel "ruggedly and simply"—personal conduct has never been any problem.

Houseparents are selected for their idealism, their creative interest, and their power to stimulate this interest in youth, rather than for their commercial ability. Among the present ranks of houseparents are farm folk, teachers, ministers, and other men and women with a genuine interest in young people and their activities.

Starting Your Community Hostel

In most European countries, the cost of building and maintaining hostels is shared by the government, park commissions, and popular subscription. In Great Britain considerable support has been received from endowments, and in the beginning the Carnegie Foundation made a contribution of $110,000. From the first day the hostels are self-supporting,

Courtesy of Ivory Photo-Engraving Co.

Spring in Michigan brings out tandem travelers. Trailer carries knapsacks

Hostel buildings should be simple and in keeping with their natural surroundings. This European hostel is located in the Swiss Alps

and it has been said that a unit will pay for itself in ten years of operation.

Service clubs, women's clubs, schools and colleges —each may build and equip a hostel. In four American cities—Washington, D.C., Madison, Detroit, and Minneapolis—hostels are granted funds by local community chests.

At this time when many communities are considering plans for honoring their war dead, much thought is being given to establishment of memorial hostels. A fountain of inspiration for the younger generation, they could be erected for less than many less suitable memorials. This is not an entirely new idea, for after World War I a number of memorial hostels were dedicated in Continental Europe and in England. This subject is discussed more fully in a booklet now in preparation by Howard Dwight Smith, architectural adviser for Ohio State University.

The details of arranging for a hostel in your community must be left to you. For surely your young people deserve hosteling! What it will mean to America if her youth—from all counties, states, and regions; of all races, creeds, and national origins—can travel and live together. If they can feel at home in their own country, it is not too much to hope that some day they can feel at home in the whole wide world.

PLANNING THE FINE ARTS PLANT FOR COÖRDINATION AND FLEXIBILITY OF USE

Sculpture studio, projecting from south loggia, Art Building

Introduction

By H. K. NEWBURN, Dean, College of Liberal Arts
and EARL E. HARPER, Director, School of Fine Arts
College of Liberal Arts, The State University of Iowa, Iowa City

THE School of Fine Arts at the State University of Iowa was established as a unit of the College of Liberal Arts in 1929. It includes the departments of art, dramatic art, and music. Students may major in the departments of the School and earn the degree Bachelor of Arts, Bachelor of Fine Arts, or Bachelor of Music through the College of Liberal Arts. In the Graduate College, students may proceed to the degrees Master of Arts, Master of Fine Arts, and Doctor of Philosophy.

Experiences Are Diversified and Integrated

The School is administered through the College of Liberal Arts and the Graduate College by the director, who serves also as the director of the Memorial Union, and by the department heads. The three departments are housed separately in buildings designed specifically for and confined entirely to their use.

Since the School operates as an integral part of the College of Liberal Arts and the Graduate College, one of its outstanding characteristics is the manner in which the fine arts are integrated with the other liberal disciplines in providing a well-balanced cultural background. This characteristic is illustrated by the fact that even in the Bachelor of Fine Arts degree the student must meet the same college requirements as those for the Bachelor of Arts or Bachelor of Science degrees in any other department.

Another basic assumption around which the program has been organized is that of developing concurrently the theoretical and the applied—the history and appreciation of art along with its practice. These aspects of art education are coördinated in such a

manner as to develop an understanding of the history, criticism, and theory of the specific art along with studio practice and creative experience. Artists and art scholars work hand in hand to integrate these experiences and make them functional.

Planning Stresses Coördination in Subject Area

It is clear then that, in planning the physical facilities for the School of Fine Arts, considerable effort naturally would be directed toward providing an environment which would lend itself to the types of coördination outlined above. In fact, as will be demonstrated later, more attention has been paid to such problems in planning the physical setting than to the problem of integrating the various departments within the School. The music unit, for example, is separated from the dramatic art and art units by considerable distance. While future plans envision the completion of a fine arts area with music housed near the other units, the present arrangement has not proved to be a serious problem in the operation of the School.

In presenting the material below, an effort has been made to indicate not only the present facilities and their advantages, but also the inadequacies of the physical setting and the modifications which could be made to improve the housing of the departments in a functional sense.

The Art Unit

By LESTER D. LONGMAN

Head of the Art Department

THE art building, completed in 1936, houses thirteen good-sized studios equipped with north skylights and excellent facilities for drawing, painting, sculpture, and design. Additional studios in the basement, lit by windows high on one or two walls, are used for crafts, lithography, etching, silk screen, fresco, and picture framing. The large studios projecting to the north and south of the main building, and connected to it by loggias, are of a size to accommodate large scale sculpture and murals.

Library Is Center of Study

The northeast rooms of the first floor, which were not designed for any specific purpose, have been converted into a library. This is the center of study for the history of art courses and houses as much as space permits of the illustrative material used directly in the studios. The books and collection of mounted photographs and slides are among the chief means of integrating historical and critical studies with studio techniques. The principle of fusing the theoretical and technical approaches to art at all levels of education is fundamental in our educational policy. It is promoted by the unification of all study and instructional facilities in the same building.

The center of the building is occupied by a large gallery for the presentation of traveling exhibitions and student work. This gallery extends through two floors and is lighted entirely by artificial illumination from above. Exhibitions are chosen for their value to the student both in history of art and studio work.

Large and Small Lecture Rooms and Seminar Room

In the center of the building on the basement floor is an auditorium seating approximately 300. The large lecture classes in the history and theory of art are held here, as well as public lectures and conferences on art. The walls, covered with wall board and painted burlap, are used for supplementary exhibitions and are separately lighted.

Illumination in the auditorium is controlled by rheostat lights which may be dimmed for use when slide material is shown, thus enabling students to have sufficient light for note-taking without affecting appreciably the clarity of the image on the screen. The rheostat lights have modern, shielded fixtures set in the ceiling. The large 20-foot beaded screen accommodates two lantern slide images side by side for comparative purposes. It hangs a foot away from the wall to enable pictures to be hung on the wall behind it. The screen is operated electrically to prevent damage in raising and lowering it. The lanterns are operated by electricity but may be operated by hand from a signal given by the lecturer whenever he prefers. Each lantern accommodates 52 slides which may be inserted in a few minutes at the beginning of the lecture and quickly removed at the end. The lanterns, screen, and all lights are operated from a fixed lectern, the wires being run under the floor. The rows of seats in the auditorium are on shallow steps rising from front to rear, so that the screen may be seen easily by all students. Space is provided in the fireproof lantern booth for a cinema projector.

A smaller lecture room in the building seats about 75, and a small seminar room is equipped for advanced courses.

Library and Exhibition Space Reveal Inadequacies

As in all such buildings, ours has certain deficiencies which were not foreseen. It is large enough for our use at present but cannot easily be enlarged to take care of future needs. It would have been preferable to place the library in the center of the building and to make it large enough to take care of all possible contingencies. At present, the slides and mounted photographs must be stored in a room on the opposite side of the building from the present library. In the near future, additions will have to be made to the building to accommodate library expansion. No staff offices were incorporated in the original plan, and the storage room is inadequate. The ceiling of the auditorium is too low to show moving pictures with an

View in east corridor, first floor, Art Building

image large enough for persons seated at the rear.

Except in the basement, the walls are of painted plaster and have moldings for hanging pictures. It would have been preferable for all walls in halls and studios to be of plywood panels covered with painted burlap or monks cloth so that pictures, whether mounted or framed, could be hung quickly and without wiring wherever desired and at any height.

The large exhibition gallery is wasteful of space from the point of view of exhibitions. It would have been more useful had it been one floor in height and divided into small rooms with movable partitions. Far more pictures could then have been hung, the design of exhibitions would be more effectively accomplished, and the rooms could be changed in shape in accordance with the nature of the exhibition. Without adding to the number of cubic feet in the building, this would have made possible another floor above of equal size and similarly partitioned for the development of a permanent collection. As it is, we do not have space for the storage of a permanent collection of works of art and for the proper presentation of it.

As now designed, the building has too many entrances and exits, so that it is difficult to guard valuable paintings exhibited in the gallery and the student work on view in the halls and auditorium.

There is inadequate space for storage in the building, particularly for the paintings and sculpture by students which we keep for exhibition and for circulation on the campus and elsewhere. The addition of some space in the form of small rooms or cubicles for graduate students would be desirable, both for the study of books and illustrations and for advanced studio work. While we have private studios for members of the faculty elsewhere on the campus, it would be preferable to have as many studios as there are faculty members connected with or closer to the art building. If some of the student-painting studios (all of which are lit only by skylights) had been designed with a view out over the campus, landscape painting would have been encouraged.

No space is provided for a kiln and wheels for the firing of terra cottas and the production of ceramic art.

The auditorium, the gallery, and most of the studios do not have natural ventilation. The artificial ventilation now provided by an air-cooling system eventually must be replaced by a complete modern air-conditioning system.

On the whole, however, the building is more effective than most university art buildings and has been adapted successfully to the combination of intellectual and technical studies characterizing the university art curriculum.

The Theatre Unit

By E. C. MABIE

Head of the Speech and Dramatic Art Department

CAREFUL definition of function, skilful solution of structural problems in the service of those functions, imaginative architectural design nicely governed by those functions—these have brought many satisfactions to those who work in the University Theatre at Iowa. Sympathetic cooperation in the planning of every cubic foot by theatre director, structural engineer, and architect was responsible for a plant which was constructed with great economy and no significant errors in plan and, after seven years, has proved to be of maximum usefulness.

Stage Space

Workshop

For classes in the various arts of the theatre, basic stage space has been well planned. The workshop for the design and construction of scenery is 40′ x 60′, has a ceiling height of 22′, and is lighted in the day-

time by huge windows on the north. It is equipped with a counterweighted paint frame on a wall 36′ high, operating in such a way as to make it possible for those who do the painting to work on the shop floor level. The shop is equipped with power saws, drills, joiners, and other tools, so that it is possible to design, build, and paint scenery for all productions. Heavy scenery can be constructed and painted on the wagons in the shop and moved, without alteration, through huge folding doors, into the acting area as the tracks on which the wagon stages operate extend into the shop.

Acting and Operating Areas

The stage itself consists of two parts, an acting area and an operating or wagon stage area. The acting area is 42′ deep by 56′ wide and adjoins an operating or wagon stage area which is 42′ deep and 75′ long. Over the acting area, it is possible to use three major scene shifting devices: (1) a counterweight system operating over a gridiron which is 56′ from the stage floor, (2) a system of wagon stages operating on tracks embedded in the stage floor, and (3) a revolving stage which is 36′ in diameter and so carefully designed as to be noiseless in operation. The stage is thus equipped to meet every demand of the modern dramatist for scene changes which are swift, for movement of heavy units, and for conventional methods of "flying" in combination with either the revolving stage or the wagon stages.

The floor of the revolving unit is fitted with two sets of traps which can be turned to those locations within the setting where they may be needed. The mechanism is simple and has been operated by stu-

View of workshop, University Theatre

Construction detail, revolving stage, University Theatre

Costume shop, University Theatre

dents in training for seven years without accident or injury to persons or equipment. The turntable is operated by push-buttons at the stage manager's desk, and the counterweight system from the stage floor. The wagons roll along the tracks under a slight push by student stage hands. This entire backstage equipment is operated by students in training, and, for the duration, the crews are composed of women.

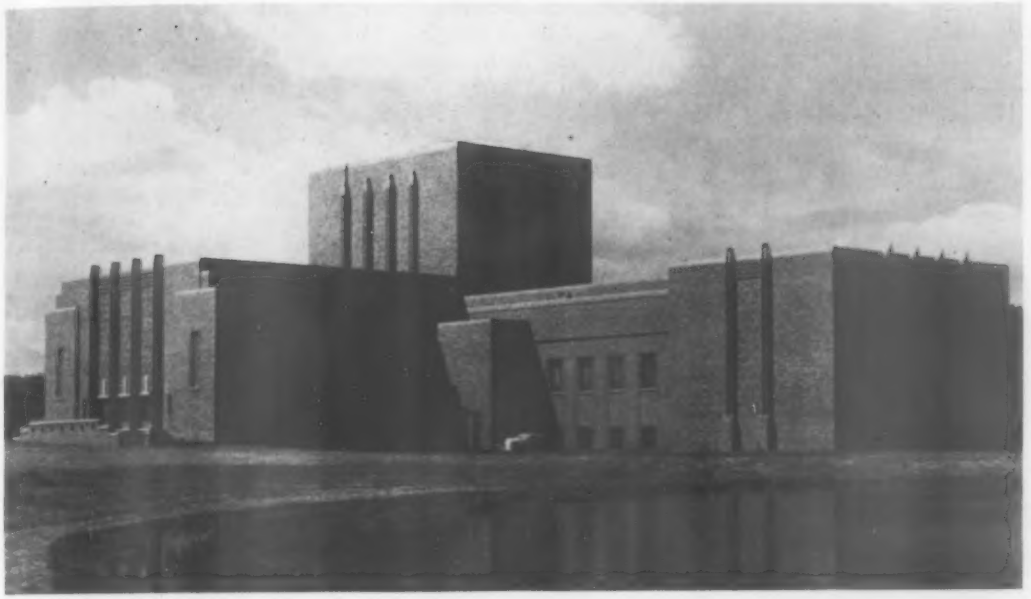
Costume Design and Storage

Facilities are also provided for the design, construction, and storage of costumes. One large room 40′ x 60′ and one small dye room 16′ x 16′ are devoted to the costume department. These are equipped with sewing machines, facilities for dyeing fabrics, and storage space for a wardrobe which now includes approximately 1,200 costumes. This, too, is operated by students in training under faculty supervision.

Lighting

The system of lighting in the University Theatre is electronic, flexible, and operated by remote control. In the rear of the auditorium is a glass-paneled control room affording a full and direct view of the stage for the lighting control operators. Here is the small control board consisting of individual dimmer circuits and master dimmers, with finger-tip sized handles all within easy stretch of one person's arms. The height of the board is such that a person of average height can comfortably see over the top for an excellent view of the stage. In this position, with controls of such small size and capable of subtle movement, accurate timing of lighting cues and smooth blending is a commonplace in stage lighting. The actual dimming is done by reactance dimmers and Thyratron electronic tubes in a remote control rack under the stage. Through an interconnecting panel offstage left,

The light bridge, University Theatre



University Theatre, exterior view

the 100 outlets distributed about the stage can be connected in any combination to the 48 dimmer circuits on the control board. This gives a maximum of flexibility to the system.

The outlets to which any lighting instruments, such as spotlights, can be connected, are located in the stage floor, on the lighting bridge in the ceiling beam of the auditorium and in the floor of the revolving unit. Spotlights and other lighting instruments are mounted in the ceiling beam, on the lighting bridge; hang from the gridiron just back of the act curtain (controlled vertically and by electric motor from the counterweight rail); they hang on other pipe battens from the gridiron by the sets of lines previously mentioned; and are mounted on a tower 18′ high that can be moved about the stage on casters.

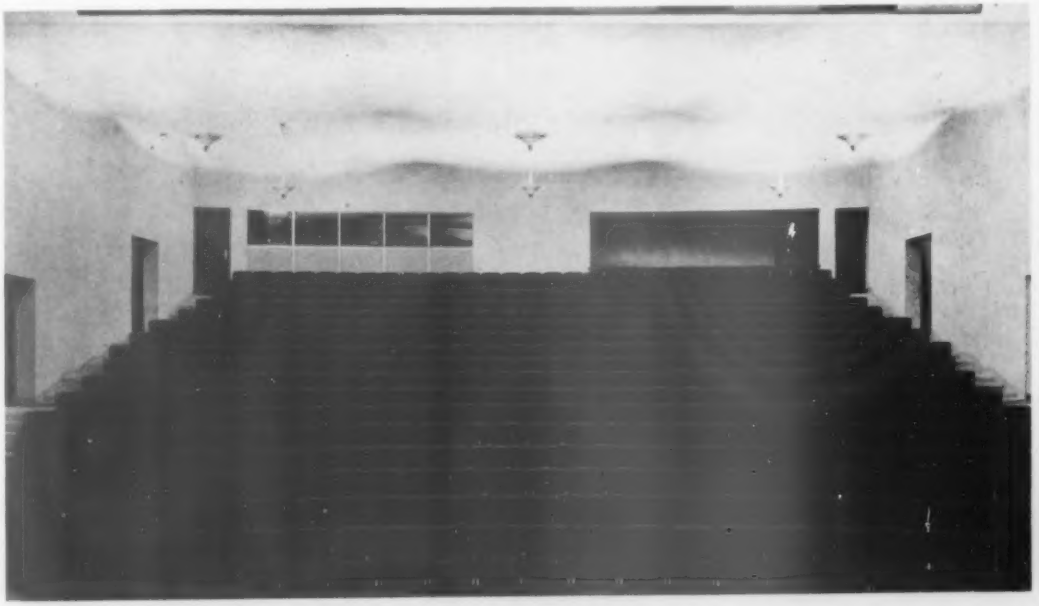
The tower is especially useful for sunlight and moonlight effects. A battery of floodlights overhead changes the large cyclorama (55′ x 102′) from day to night or vice versa, and striplights on the stage floor produce dawns and sunsets on its surface. Linnebach projectors and lens-effect machines decorate the cyclorama with distant mountains, clouds, rain, or other scenic designs required by the drama.

With the addition of new lighting instruments, this highly flexible system of control should be capable of producing the most effective lighting imaginable on any stage. Although this equipment comprises best modern electronic instruments, it, too, has been simplified so that it is regularly operated by students working under faculty supervision.

Theatre Basement

Dressing Rooms

The basement of the theatre was designed with 14′ ceilings, so that all space would be usable without the cramped depressed effect common to basements.



University Theatre, interior of auditorium

In this basement are two large dressing rooms fitted with individual lockers, toilets, showers and wash basins, and "make-up" room facilities. Each of these rooms will accommodate 20 players comfortably. As need arises, quick-change and single dressing rooms for players are constructed on the wagon stage area near the setting. In the south wing yet to be built, there will be several small dressing rooms to accommodate one or two players who may be performing exacting roles requiring concentration of thought and effort.

Offices and Lounge

Several staff offices are temporarily located in the basement which houses also a much-used classroom and a large lounge for both players and theatre-goers on the evenings of performances. The lounge is also the setting for plays produced in "penthouse" or drawing room manner. When used in that way for comedies, it seats comfortably an audience of 75 persons.

Auditorium

The auditorium of the theatre is constructed on the pattern of an arena with a solid tier of 477 seats unbroken by longitudinal aisles. The space between rows of seats is so generous that each row is a transverse aisle. With three exits on each side of the theatre and six ample vomitories leading to the foyer, the auditorium can be cleared of its audience in less than three minutes. Sight lines from every seat in the house are good and the acoustics are excellent.

No orchestra pit separates the audience from the players; the first row of spectators is but a dozen feet from the curtain line, and the stage floor is only three easy steps higher than the floor on which the first row of seats is placed. The result is an intimate theatre effect which is a delight to audience and players alike. Each row of seats is from five to seven inches higher than the row in front of it. Consequently, even hats do not interfere with sight lines.

The auditorium is served by an air cooling system with two plants, one a well furnishing water continuously at 52°F and another, a steam jet system, which is called into service on excessively warm days in the summer session. The seats are large, heavily upholstered in dark blue. An electric Orgatron provides before-curtain selections and entr'act music and frequently enhances the production of the play itself.

The South Wing

The south wing, yet to be built, will contain a much needed studio-theatre, perhaps in the style of the Elizabethan theatre. It will house a theatre collection for study of all history and appreciation of the drama, a study-hall library where students can work when they are off-stage during rehearsal, classrooms, a drawing-room theatre, voice recording equipment, laboratory, broadcasting and television rehearsal rooms, and staff offices.

Unique provision is made for playwrights whose work is in experimental production of new plays through studios and a library. There are facilities for work in cinematography, for the making of films of classics of the theatre, for research in voice and speech for the stage, and for experimentation in stage lighting and in experimental esthetics of the theatre. But the construction of the south wing which will provide new housing for these projects must wait until after the war.

The Music Unit

By P. G. CLAPP

Head of the Music Department

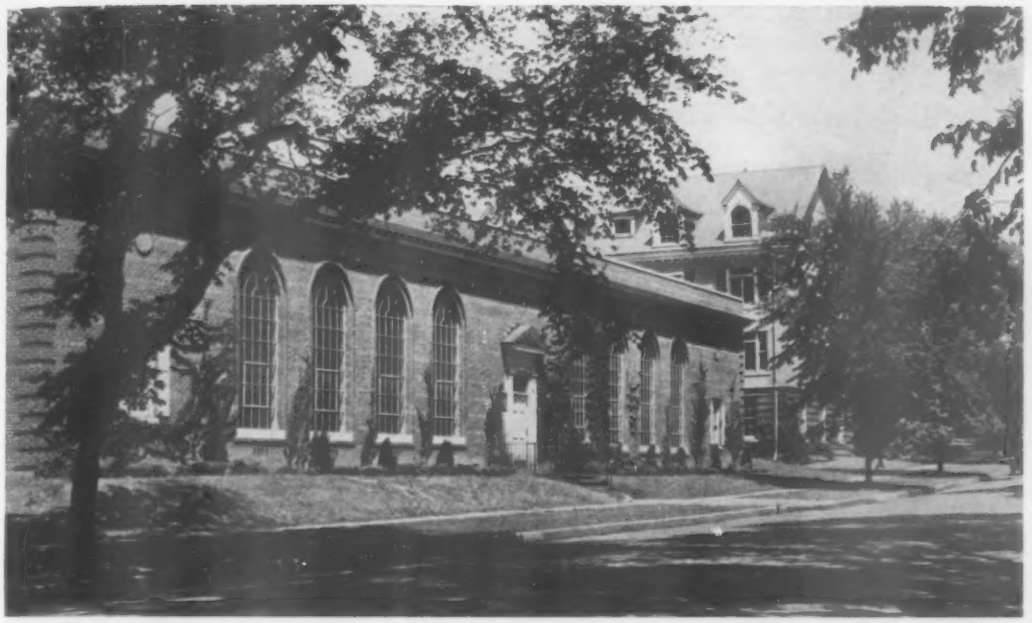
THE music department offers a balanced curriculum of theory and practice in small and large classrooms, studios for individual instruction, individual practice rooms, rooms for practice of small ensembles, and small halls for practice of large ensemble groups and for presentation of recitals; it maintains considerable musical equipment for instruction and practice, and storage space for the safekeeping of such equipment.

The two rehearsal halls (see illustration), each 50 feet wide, 80 feet long, and 21 feet high, are separated by two stout walls and intervening rooms. A stage 50 feet by 27 feet is located at the farther end of each hall. Small storage rooms adjoin the respective stages. Acoustical treatment in the halls is designed to produce an auditory effect upon performers similar to what they will experience in a public performance in a larger hall.

The halls are open to the following criticisms:

The stages do not allow aisle space for passing beside and behind a large organization; the adjacent storage space has been found insufficient, so that some equipment has to be carried by hand for considerable distances. We recommend stages 60 feet by 30, and much greater storage space adjacent to the halls. Storage should be sufficient to care for all institutional instrumental equipment and printed music, band uniforms, choir vestments, etc., which could be so arranged as to be readily accessible for authorized use. Material should be stored near the place where it is commonly used as hauling shortens the life of equipment. Frequent tuning and mechanical reconditioning of equipment should be provided for. Rooms in which equipment is used or stored should be kept at a nearly constant temperature.

The studios in the music department building, aver-



Music Building: rehearsal halls in foreground, studio building in background. Solid construction and acoustical treatment insure freedom from outside disturbance in each room

aging 16 by 24 feet, and practice rooms about half this size, are all acoustically treated. The wall construction is very solid. Doors are of double thickness with weatherstripping and include a window consisting of two panes of glass of different thickness. The acoustical treatment and the double glass have proved highly efficient; but more durable weatherstripping must soon be installed.

Classrooms and one or two special rooms for the rehearsal or practice of loud instruments have received extra heavy acoustical treatment. Adequate blackboard lighting in acoustically treated classrooms has not yet been secured. Semi-indirect lighting has worked out well in the studios and practice rooms but badly in the classrooms and rehearsal halls. One rehearsal hall has now been equipped with a direct lighting system which is efficient with ceiling of 21 feet. This is probably unsuited to a classroom with lower ceiling. Covered marginal lighting for blackboards with semi-indirect lighting for the class offers some promise of solving this problem.

Stability of temperature for large and small rooms, and control of humidity to safeguard instrumental equipment, have not been provided for by the standard thermostatic devices, and this whole situation is under observation.

About three-fourths of the musical equipment of this department is of superior quality; the other fourth is of decidedly mediocre quality. Experience with both superior and inferior equipment leads to the same conclusion—the best equipment is still efficient after twenty or more years of service; inferior or so-called "medium grade" equipment is unserviceable after about a year of intensive school use.

North Rehearsal Hall: Orchestra stage area with permanent risers in background; portable chairs in foreground are turned to face a small recital stage behind and to left of camera. Both rehearsal halls are used by chorus, orchestra, and band, as well as for small ensembles and soloists, and for student recitals and large lecture courses

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Owner: Harvard University

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Architect: Perry, Shaw & Hepburn
Owner: Harvard University

New England Deposit Library
Location: Cambridge, Mass.
Architect: Coolidge, Shepley, Bulfinch & Abbott
Owner: President & Fellows of Harvard College

Radio Research Laboratory
Location: Cambridge, Mass.
Architects: Coolidge, Shelley, Bulfinch & Abbott
Owners: Harvard University

Hemenway Building Addition
Location: Cambridge, Mass.
Architect: Coolidge, Shepley, Bulfinch & Abbott
Owner: President & Fellows of Harvard College

Freshman Dormitories
Location: Cambridge, Mass.
Architect: Shepley, Rutan & Coolidge
Owner: Harvard University

McKinlock Dormitory
Location: Cambridge, Mass.
Architect: Coolidge, Shepley, Bulfinch & Abbott
Owner: Harvard University

Law Library Alteration and Addition
Location: Cambridge, Mass.
Architect: Coolidge, Shepley, Bulfinch & Abbott
Owner: Harvard University

Dillon Field House
Location: Cambridge, Mass.
Architect: Coolidge, Shepley, Bulfinch & Abbott
Owner: Harvard University

YALE UNIVERSITY

Institute of Human Relations
Location: New Haven, Conn.
Architect: Grosvenor Atterbury, John Tompkins Assoc.
Owner: Yale University

Sterling Hall of Medicine (Library Wing Addition)
Location: New Haven, Conn.
Architect: Chas. Z. Klauder
Owner: Yale University

PRINCETON UNIVERSITY

Laboratory of Physics
Location: Princeton, N. J.
Architect: H. J. Hardenbergh
Owner: Princeton University

Palmer Stadium
Location: Princeton, New Jersey
Architects: McKim, Mead & White
Owner: Princeton University

CORNELL UNIVERSITY

Myron Taylor Hall
Location: Ithaca, N. Y.
Architect: Jackson, Robertson & Adams
Owner: Cornell University

COLUMBIA UNIVERSITY

School of Journalism
Location: New York City
Architect: McKim, Mead and White
Owner: Trustees of Columbia College

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HARVARD UNIVERSITY, CAMBRIDGE, MASS.

PURDUE UNIVERSITY

Music Hall—Purdue University
Location: Lafayette, Ind.
Architect: Walter Scholer
Owner: Trustees of Purdue University

Residence for Men—
Location: Lafayette, Ind.
Architect: Walter Scholer
Owner: Trustees of Purdue University

Chemical Engineering Laboratory
Location: West Lafayette, Indiana
Architect: Walter Scholer
Owner: Purdue University

WELLESLEY COLLEGE

Wellesley Temporary Hall
Location: Wellesley, Mass.
Architect: Shepley, Rutan & Coolidge
Owner: Wellesley College

Central Dormitory
Location: Wellesley, Mass.
Architect: Coolidge & Carlson
Owner: Wellesley College

GEORGETOWN UNIVERSITY DORMITORIES

Location: Washington, D. C.
Architect: Marsh & Peters
Owner: President & Directors of Georgetown University

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Architect: Horace Trumbauer
Owner: Duke University

UNIVERSITY OF MICHIGAN

Martha Cook Dormitory
Location: Ann Arbor, Mich.
Architect: York & Sawyer
Owner: University of Michigan

Chi Psi Fraternity Building
Location: Ann Arbor, Mich.
Architect: York & Sawyer
Owner: Epsilon Realty Company

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Owner: University of Pennsylvania

UNIVERSITY OF ALBERTA
Edmonton Arts
Location: Edmonton, Alberta, Canada
Architect: Nobbs & Hyde
Owner: Board of Governors, University of Alberta

UNIVERSITY OF TORONTO
Mill Building Addition
Location: Toronto, Canada
Architect: Craig & Madell and T. R. Loudon
Owner: Governors of the University of Toronto

CARDINAL HAYES MEMORIAL HIGH SCHOOL
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SIMMONS FEMALE COLLEGE
Location: Boston, Mass.
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Owner: Simmons Female College

ARTILLERY SCHOOL
Location: Norfolk, Va.
Architect: F. B. Wharton, Q.M. Dept.
Owner: War Department, U. S. A.

ST. MICHAELS COLLEGE
Location: Toronto, Canada
Architect: Arthur W. Holmes
Owner: St. Michaels College

CATHEDRAL DORMITORY GYMNASIUM
Location: Washington, D. C.
Architect: A. B. Heaton
Owner: Protestant Episcopal Cathedral Foundation of D. C.

COLLEGE OF PREACHERS
Location: Washington, D. C.
Architect: Frohman, Robb & Little
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McKINLEY SCHOOL
Location: Washington, D. C.
Architect: L. Norris
Owner: District of Columbia

MT. PLEASANT SCHOOL
Location: Washington, D. C.
Architect: Marsh & Peters
Owner: District of Columbia

MT. ALTO SCHOOL
Location: Washington, D. C.
Architect: Charles Francis Wood
Owner: National School Domestic Arts & Sciences, Inc.

BROOKINGS SCHOOL
Location: Washington, D. C.
Architect: Waddy B. Wood
Owner: Robt. Brookings Graduate School of E. & G.

IMMACULATE CONCEPTION SCHOOL
Location: Newburyport, Mass.
Architect: The Immaculate Conception Parish
Owner: The Immaculate Conception Parish

PUBLIC LATIN SCHOOL
Location: Boston, Mass.
Architect: James E. McLoughlin
Owner: City of Boston

NEWBURYPORT HIGH SCHOOL
Location: Newburyport, Mass.
Architect: Edwin S. Dodge
Owner: City of Newburyport

GOOD SHEPHERD SCHOOL ADDITION
Location: New York, N. Y.
Architect: Paul Monaghan
Owner: Corp. of R. C. Church of the Good Shepherd of N. Y.

CARDINAL HAYES MEMORIAL HIGH SCHOOL
Location: New York, N. Y.
Architect: Eggers & Higgins
Owner: Archbishopric of New York

GIRLS' COMMERCIAL HIGH SCHOOL
Location: Brooklyn, N. Y.
Architect: William H. Gompert
Owner: Board of Education of City of New York

SPENCE SCHOOL
Location: New York City
Architect: Office of John Russell Pope
Owner: Trustees of the Miss Spence School, Inc.

VANDERLIP SCHOOL AND LIBRARY
Location: Scarborough, N. Y.
Architect: W. W. Bosworth
Owner: F. A. Vanderlip

DOBBS FERRY HIGH SCHOOL
Location: Dobbs Ferry, N. Y.
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Owner: Board of Education, Town of Greenburgh, N. Y.

BALDWIN SCHOOL GYMNASIUM
Location: Bryn Mawr, Pa.
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Owner: Baldwin School, Inc.

BOYS' LATIN SCHOOL
Location: Cleveland, Ohio
Architect: Edward T. P. Graham
Owner: Bishop of Cleveland

HIGH SCHOOL
Location: Montreal, Canada
Architect: Edward & W. S. Maxwell
Owner: Protestant Board of School Commissions

NORMAL SCHOOL
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Owner: City of Boston

WENTWORTH INSTITUTE (East Wing)
Location: Boston, Mass.
Architect: Peabody & Stearns
Owner: Wentworth Institute

SPRINGFIELD TRADE SCHOOL
Location: Springfield, Mass.
Architect: Gardner & King
Owner: City of Springfield

NAVAL TRAINING STATION
Location: Hingham, Mass.
Architect: Public Works Office
Owner: U. S. Government

MARINE BIOLOGICAL LABORATORY
Location: Woods Hole, Mass.
Architect: Coolidge, Shepley, Bulfinch & Abbott
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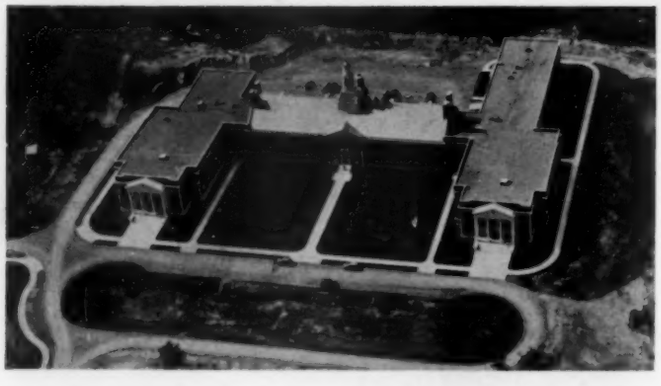
"OUR TAXPAYERS GOT A LOT OF BUILDING FOR THE MONEY THEY INVESTED . . ."

The recent letter from which the above is quoted was written by the Superintendent of Schools, Harrison, N. Y., District No. 6, Mr. Louis M. Klein, who continued . . . "and 4 years of use of this building have proved it to be a thoroughly well-constructed, practically laid out, and a genuinely usable and functional school building which has been a real asset to our community."

The impressive educational and social results which the School Board of Harrison, N. Y. has attained with this outstandingly-modern functional plant is so immediately apparent that even a layman is deeply impressed.

The precision and efficiency in human relations with which this school entity functions amply justifies the first paragraph of Mr. Klein's letter, which attitude an observer would be certain is shared by the entire school staff . . .

"I am very proud of our new High School building which was constructed in 1939-40, and which was made possible by the vision of our Board of Education and the authorization of our taxpayers. Mr. Vignola, the Architect, did an excellent job in the design and layout of the building. This has been the fourth year of use of this building which from an educational point of view has been extremely functional. The upkeep of the building has been kept to a real minimum by the type of construction and the type of materials put into the building, which have been very serviceable."



Air view of the Central School, Goshen, New York, a large and exceptionally well-appointed school building of which the impressive wings are shown in a smaller picture below. Robert R. Graham, Architect.

Above, large Central School, Dundee, N. Y. Robert R. Graham, Architect. Below, Elementary School, Montpelier, Vermont, also designed by Robert R. Graham, Architect.

The four views, left to right, Fort Ann School, Fort Ann, N. Y. Carl W. Clark, A.I.A., Architect.

Close-up view of one wing, Central School, Goshen, N. Y. Robert R. Graham, Architect.

Night view, Junior-Senior High School, Harrison, N. Y. Robert P. Vignola, Architect.

Library and Reading Room, Central School, Goshen, N. Y. Robert R. Graham, Architect.

A Modern Approach to SCHOOL Construction

Above, the modern, extremely functional Junior-Senior High School, Union Free School District No. 6, Harrison and Rye, N. Y. At left, main entrance of Harrison, N. Y., Junior-Senior High School, with extruded aluminum and glass marquee and impressively large extruded aluminum windows. (See night lighting effect in smaller picture below.) Architect, Robert P. Vignola, Harrison, N. Y.

For today's requirements and for the days to come when the need for Schools and other public buildings can be exactingly met, the importance of a background of many fine schools successfully constructed is of vital importance.

The John A. Johnson Contracting Corp. has such a background, not only for Schools, and other public buildings, but also for the construction of complete cities and towns, waterworks, sewerage systems and the related utilities and facilities.

Literature will be mailed upon request

ROBERT P. VIGNOLA, Architect
Harrison, N. Y.
(Junior-Senior High School)

I wish to take this opportunity, now that the Junior-Senior High School (Harrison, N. Y.) has been completed, of expressing my appreciation of the business-like way in which your firm carried thru this half million dollar project.

I can assure you that should I have another similar project, I sincerely hope that you may be the successful bidder and that I may have the opportunity of renewing the pleasant relations that have existed throughout the entire construction of this school.

(Signed) Robert P. Vignola

CARL W. CLARK, A.I.A., Architect
Cortland, N. Y.
(Fort Ann School, Fort Ann, N. Y.)

. . . Thruout the progress of the work, (at Fort Ann) your corporation was all that one could ask and the completed product is one of which the School authorities, the State authorities and this office are justly proud.

Our administration work was made easy due to the efficient office practices of your company.

(Signed) Carl W. Clark, A.I.A.

ROBERT R. GRAHAM, Architect
Middletown, N. Y.
(Goshen, N. Y., Dundee, N. Y., and Montpelier, Vt.)

The issuance of your final payment on the Goshen project brings to a conclusion 3 years of close association with you on the construction of 3 of my largest school buildings.

It seems appropriate now to thank you for your careful work and to congratulate you on your organization, your superintendence and ability to expedite your work.

It has been a pleasure to work with you, and I trust that we will soon have work which will be of interest to you.

(Signed) Robert R. Graham

"A Firm Foundation Since 1896"

Send for Brochure A 64

TURNER CONSTRUCTION COMPANY

Founded 1902

BOSTON **NEW YORK** **PHILADELPHIA**

EXPERIENCE We offer experience gained in the construction of more than 2,000 buildings costing over $700,000,000 completed during the past 43 years.

ORGANIZATION Our 14 active Officers average 30 years of service with our Company. We have more than 30 Superintendents who average 17 years' service with us. Our 125 active Foremen average 15 years' service. These men create dependable, efficient field organizations. They are supported by "inside" staffs of Purchasing Agents, Engineers, Expeditors and Accountants with similar service records.

Thus, both "line" and "staff" are widely experienced and thoroughly familiar with our methods.

COST CONTROL Every job is budgeted for time and cost. All labor and material items are classified. Actual costs are compared regularly with the budget and control of the cost of the work thereby maintained. The actual costs are projected to indicate the final cost and methods adopted promptly to correct those out of line with the budget.

Our financial strength is a factor in securing the lowest prices in the purchase of materials and in the letting of subcontracts.

Owning and maintaining our own equipment makes for having the most economical plant layout for each job.

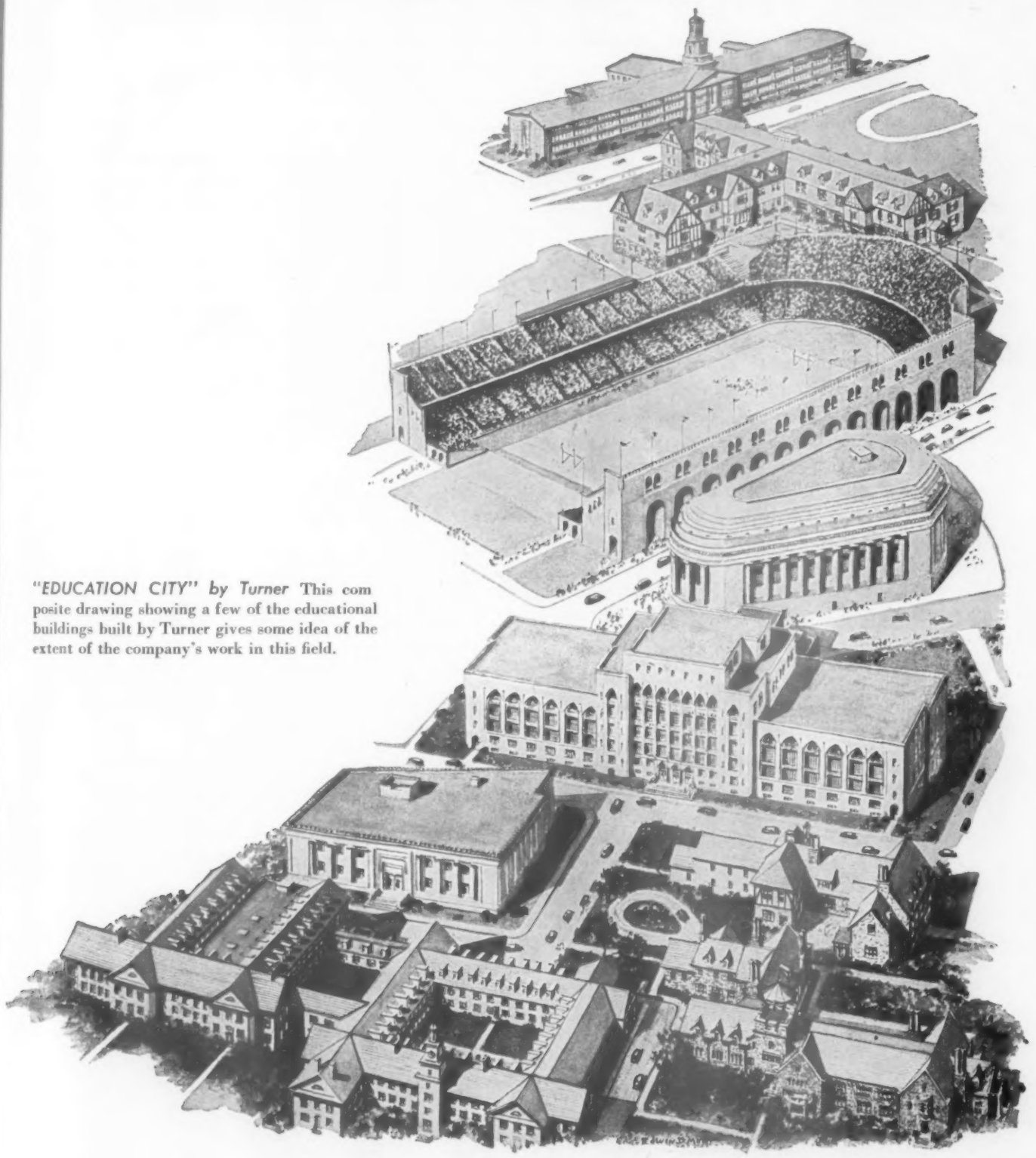
PERFORMANCE More than 60% of our work represents repeat orders from satisfied clients.

The more than half a billion dollars of contracts we have secured were obtained about 40% in lump sum competition and 60% on cost plus a fee basis. Eliminating the work done in World Wars No. 1 and No. 2, about 50% of our business normally is secured in lump sum competitive bidding—the remainder as a result of selection on a fee basis—a well balanced and healthy relationship for any contractor—it tends to preserve his "Cost Consciousness."

INSTITUTIONAL CLIENTS

Schools — Colleges — Churches — Libraries — Museums

Julia Dyckman Andrus Memorial
Boston University
Brown University
Brearley School
Buffalo Academy of the Sacred Heart (Stella Niagara)
Cornell University
Delaware School Foundation
Drew University
Fitchburg High School
Friends Academy
Girard College
Harvard University
Holy Name College
The Masters School
James Madison High School, N. Y. City
Public School No. 210, N. Y. City
Rhode Island School of Design
St. Andrew's School
St. Lawrence University
University of Pennsylvania
University of Pittsburgh
Van Hornesville School
Wilmington Technical High School



"EDUCATION CITY" by Turner This composite drawing showing a few of the educational buildings built by Turner gives some idea of the extent of the company's work in this field.

THE PHILIP CAREY MFG. COMPANY

Manufacturers of

Roofing and Waterproofing Products, Heat Insulations

Lockland, Cincinnati, Ohio

The roof of a school building represents little more than 1% of the total construction cost yet on its durability and weather-resisting qualities depend the protection of the other 99%. The school roof should be designed and built to last the life of the building. Re-roofing is an expense that need not be incurred under ordinary conditions if the right roof is selected and properly constructed.

SPECIFY

Carey ROOFS

FOR LASTING PROTECTION

Carey Roofs meet every requirement for modern school construction. For more than forty years Carey Roofs have been specified for important public buildings throughout the United States, and their application to new school construction is increasing year by year because they have proved their durability and lasting protection against weather.

The quality of materials entering into Carey Built-Up Specifications are carefully checked by our engineering department and research laboratory, allowing a liberal factor of safety as to tensile strength, number of plies and thickness of plies, to assure adequate and permanent weatherproof protection.

FREE ROOF SURVEY

The Carey Roof Survey Plan has been in operation for several years and has been the means of cutting roofing upkeep expense to a minimum. Without obligation on your part, a Carey Inspector will make a careful survey of your roofs, flashings, parapets, etc., and give an honest and impartial report on their condition.

Carey Asfaltslate Shingles represent the standard of quality in composition shingles. They are built especially rugged and substantial to give extra years of trouble free service. They are proof against all ordinary fire risks and need no paint or other upkeep expense.

Careystone Asbestos Cement Shingles. Made of asbestos and cement, they provide a permanent roof possessing natural properties that enable it to resist the destructive influences of time, weather and fire.

Carey Heat Insulations. For low pressure steam or hot water heating systems, Careycel Pipe Covering has no equal. It combines high insulating efficiency with low cost. The Carey Heat Insulation Line is complete. A special insulation material to meet every service condition. Temperature ranges from zero to 2500° F.

Carey Rock Wool Building Insulation provides greater comfort, lower cost of heating and when properly installed corrects condensation problems. Made of minerals, Carey Rock Wool will not char and is fire-resistant.

Carey Waterproofing Materials. Carey waterproofing for basement walls and swimming pools; Protective coatings to repair leaks and prolong the life of all types of roofs, protection paints for hot and cold metal surfaces.

Other Carey Products include Careystone Asbestos-Cement Wallboard and Sheathing, Asphalt Tile Floors and Expansion Joints.

THE PHILIP CAREY MFG. COMPANY

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THE AMERICAN SCHOOL AND UNIVERSITY—1945

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Manufacturers and Distributors

CONSTRUCTION MATERIALS

6051 West 65th St., Chicago 38, Ill.

REPRESENTATION IN ALL PRINCIPAL CITIES

Building Products — Sewer Jointing Materials — Industrial Products

A POSITIVE SEAL FOR ROOFING

PARA-PLASTIC is a hot poured waterproof material recently developed to possess the necessary qualities as a positive seal for roofing maintenance. This material is a rubbery, resilient and adhesive plastic when heated and poured into various openings and crevices. PARA-PLASTIC differs greatly from the ordinary asphalt, or coal tar pitch because, it will not run or flow during hot weather — and will maintain a perfect bond without cracking in zero weather. PARA-PLASTIC will adhere and bond firmly with any form of construction, such as: metal, wood, felt or concrete.

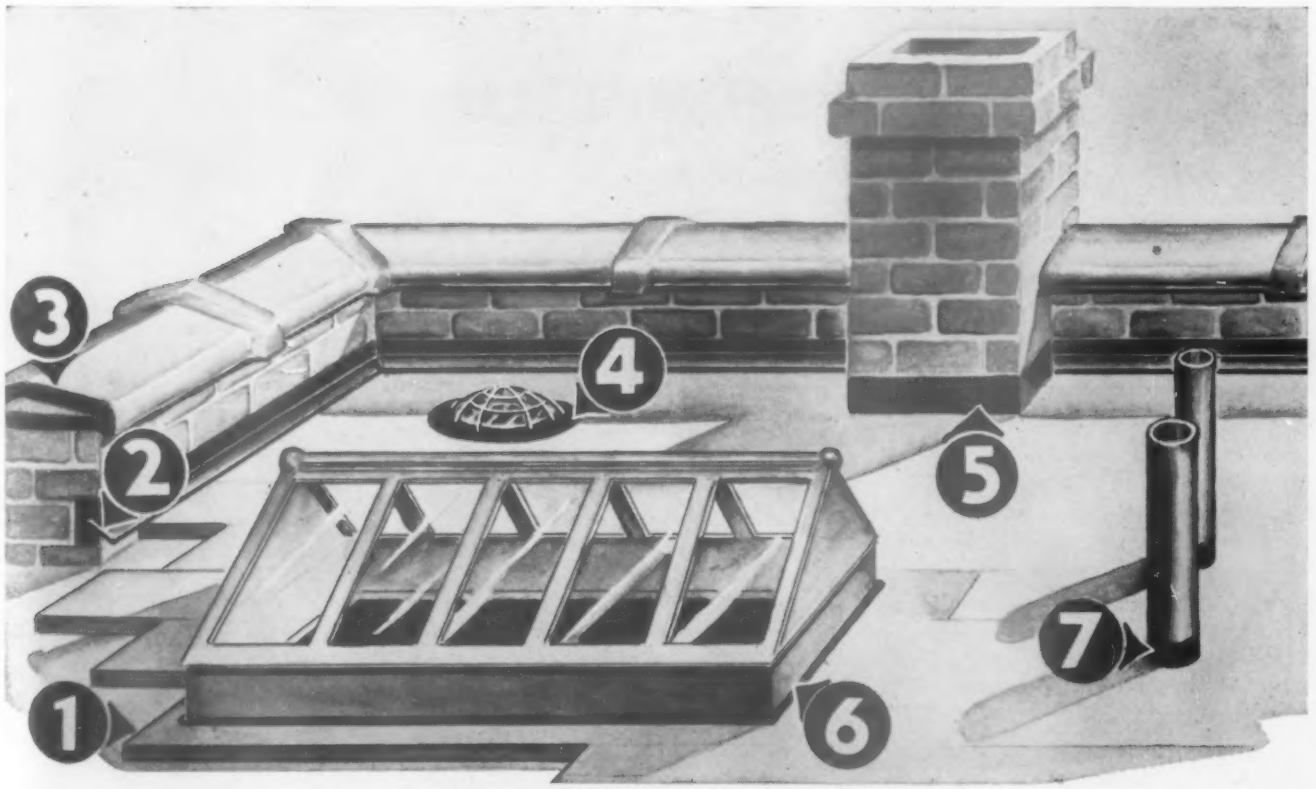
ASPHALT PLANK FOR ROOF DECKS

Servicised Asphalt Plank has been used for roof decks for many years. This plank arrives on the job in any required size and thickness and is ready for immediate installation. Long wearing—light in weight—waterproof and low cost, make our asphalt plank outstanding in roofing. Our PARA-PLASTIC compound is used in conjunction as a positive joint seal. Prices can be quoted best by estimating area of roof to be covered. Samples of Asphalt Plank will be sent upon request.

Manufacturers of various roofing specialties for over 25 years

7 Logical Reasons For Roofing Maintenance

1. **The proper method of sealing joints during the installation of asphalt plank when applied on roofs.**
2. **The use of a proper cohesive and adhesive plastic during installaton of flashing blocks.**
3. **An adhesive plastic that will bond firmly without cracking, wherever cracks or openings appear on topping blocks.**
4. **Complete protection against open crevices around the trap drain.**
5. **Assurance of a positive seal against seepage of water along the side and base of the chimney.**
6. **Protection against water seepage around sky-lights; especially during the period of contraction.**
7. **Proper seal that will bond with the vent pipes and roofing material at all times without cracking.**



WESTERN WATERPROOFING COMPANIES

Waterproofing and Weatherproofing Contractors and Engineers

PENNSYLVANIA CORPORATION
PHILADELPHIA 7, PA., Liberty Trust Building
SCRANTON, PA., 711 Linden Street
HARRISBURG, PA., 1515 No. Cameron Street
BALTIMORE, MD., 308 Baltimore Life Building
WASHINGTON, D. C., 1427 Eye Street, N. W.

NEW YORK CORPORATION
NEW YORK 17, N. Y., Grand Central Terminal Building
BOSTON 18, MASS., 82 W. Dedham Street

MICHIGAN CORPORATION
DETROIT 26, MICH., Murphy Building
CLEVELAND 14, OHIO, Builders Exchange Building
TORONTO 2, ONT., 67 Carlton Street
MONTREAL, QUE., Keefer Building

OHIO CORPORATION
CINCINNATI 2, OHIO, 401 Schmidt Building
LOUISVILLE, KY., 633 So. Fifth Street
INDIANAPOLIS, IND., 804 Lemcke Building
DAYTON, OHIO, 494 Commercial Building

CHICAGO AND SURROUNDING TERRITORY
CHICAGO 2. ILL., Central Ironite Waterproofing Co., Conway Building

The above mentioned companies are independent corporations and have no financial responsibility for each others acts

IRONITE
Below Grade Waterproofing

For Basement Walls and Floors
Tunnels, Sewers, Pools and Tanks

IRONITE—WHAT IT IS—"GENUINE IRONITE" is composed of over 90% chemically pure iron, pulverized and carefully graded, plus an activating agent. This agent oxidizes the iron particles in the presence of water causing them to swell and lock themselves mechanically in the pores of leaking masonry (brick, stone, concrete) walls and thoroughly and permanently seal the masonry walls against the passage of water. "IRONITE" has been in continuous use for over 35 years.

Trade Mark—The "IRONITE" Trade Mark is owned by the Ironite Company of Chicago, territorially licensed for use to the various Western Waterproofing Corporations.

ADVANTAGES—The Westen Waterproofing Companies' IRONITE Waterproofing Method has outstanding advantages over other types.

(1) IRONITE is usually applied, under ideal working conditions, to the inside of masonry basement and similar walls after erection. It can be readily and inexpensively repaired in case of structural cracks or breaks of any kind without the necessity of excavating. Unlike membrane waterproofing, IRONITE, in the process of oxidation, fills the pores of the masonry walls and becomes a hard, finished integral part of the structure requiring no protection against abrasive injury.

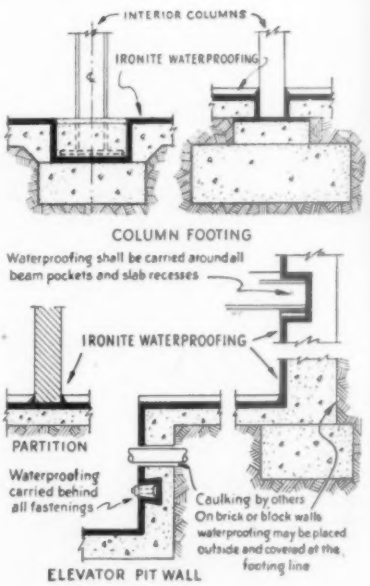
(2) It can be applied to either a wet or dry surface.

(3) Its application will resist any hydrostatic pressure which the structure itself is capable of withstanding.

(4) Eliminates the necessity of maintaining open-work space trenches and dust dry working conditions for application.

(5) IRONITE Waterproofing is permanent, increasing in hardness with age. It actually lasts as long as the structure itself.

(6) It is equally adaptable to new or existing structure.


INTERIOR COLUMNS
IRONITE WATERPROOFING
COLUMN FOOTING
Waterproofing shall be carried around all beam pockets and slab recesses
IRONITE WATERPROOFING
PARTITION
Waterproofing carried behind all fastenings
Caulking by others On brick or block walls waterproofing may be placed outside and covered at the footing line
ELEVATOR PIT WALL

ENGINEERING SERVICES—Each waterproofing problem requires individual solution. The Western Waterproofing Companies, with over 30 years of successful waterproofing accomplishment, maintain, in the various territories served, competent waterproofing engineers for consultation and advice. Estimates and detailed specifications applicable to the specific work will be cheerfully furnished.

GENUINE IRONITE is applied only under contract by Western Waterproofing Companies' experienced workmen—no material is for sale. All work is fully guaranteed.

WESTERN WATERPROOFING COMPANIES

Waterproofing and Weatherproofing Contractors and Engineers

Brick joints waterproofed and weatherproofed with RESTO-CRETE

Prevents Moisture Damage—Restores and Decorates Exposed Masonry

RESTO-CRETE
Above Grade Weatherproofing

BEFORE and AFTER RESTORATION

RESTO-CRETE—WHAT IT IS—RESTO-CRETE Grout, a product of many years of research and field proven durability, is a protective and decorating weatherproof coating composed of cementatious materials plus certain admixtures and colors. The standard 7-day compressive strength test of the base material is over 3,200 lb. per sq. in. **Absorption in boiling water compared to normal Portland grout is very low, being less than 7% in 24 hrs.** Technical data is available.

Trade-Mark—The "RESTO-CRETE" Trade Mark is owned by the Western Waterproofing Company of Detroit, territorially licensed for use to the various Western Waterproofing Corporations.

TYPES OF WORK—The following types of work have been successfully weatherproofed and/or restored by us under our guarantee of satisfaction. Lists and data of accomplishment furnished on request:

Old Concrete—Buildings of all types, abutments, dams, chimneys, piers, elevators, etc. Sand-blasted as required, chipped; patched with IRONITE Mortar; plastered as required. Finished with RESTO-CRETE to prevent water penetration and to decorate.

New Concrete—Surface plastered smooth or left rough as desired. Finished with one or two coats of RESTO-CRETE.

Swimming Pools—Waterproofed with IRONITE and plastered from rough concrete. Special non-peeling, glossy decorative treatments in white or colors.

Plaster and Stucco—Complete repair of broken areas, using special high-strength plaster. Finished with one or two coats of RESTO-CRETE.

Cinder, Concrete, Haydite, Etc., Block Surfaces—Federal housing jobs, residences, etc. Two coat treatment leaving rough or plaster-like smooth texture. (We believe it the most durable, weatherproof treatment in existence.) Economical and effective.

Brick, Stone Walls—Where only joints leak, hollow and defective joints repointed, then all joints surface-grouted with RESTO-CRETE. Less expensive than a first quality repointing job, and fully as effective. Where both brick and stone leak, entire surface treated without marring the architectural effect. Where stone surface is disintegrated, it is completely rebuilt to original contours and resurfaced.

Cast (Artificial Stone and Terra Cotta)—Complete resurfacing by special patching, thin plastering operations. Finished with RESTO-CRETE to look like new Limestone.

ENGINEERING SERVICES—The Western Waterproofing Companies in the various territories maintain experienced Weatherproofing and Restoration engineers for consultation and advice. Special problems in insulation, acid and alkali proofing, etc., are handled from our well-equipped research laboratories in Detroit. Submission of difficult problems for solution is welcomed.

RESTO-CRETE treatments are applied only under contract by Western Waterproofing Companies' experienced workmen—no material is for sale.

RESTO-CRETE SYSTEM

THE TEXAS COMPANY

Manufacturers of

TEXACO ASPHALT SHINGLES and ROOFING

FACTS ABOUT TEXACO ASPHALT ROOFING FOR SCHOOL AND UNIVERSITY USE

Lasting Economy

Texaco Asphalt Shingles and Roofing offer more advantages dollar for dollar than any other type of roofing.

Fire Underwriters' Approval

The Underwriters' Label is your assurance of protection against flying embers and sparks. This may permit reduction in insurance rates, subject to local fire conditions.

Protection Against the Weather

Asphalt is the oldest and most widely used weather- and water-proofing agent known to man.

Meets All Requirements

Texaco Asphalt Shingles and Roofing meet U. S. Army, Navy and other government specifications—meet or exceed structural specifications for educational buildings, both for new work and for re-roofing.

Attractive Appearance

Accepted patterns and pleasing colors make Texaco Asphalt Shingles and Roofing highly suitable for school and university use—blending with any architectural style.

Asphalt — Most Popular Type

Today asphalt is the most popular type of roofing in America. Economy, attractiveness and protection are the reasons for this preference over all other types of roofing.

Texaco Quality Well Known

Texaco Asphalt Shingles and Roofing maintain the standards of quality and dependability established by each of the more than 350 petroleum products of The Texas Company.

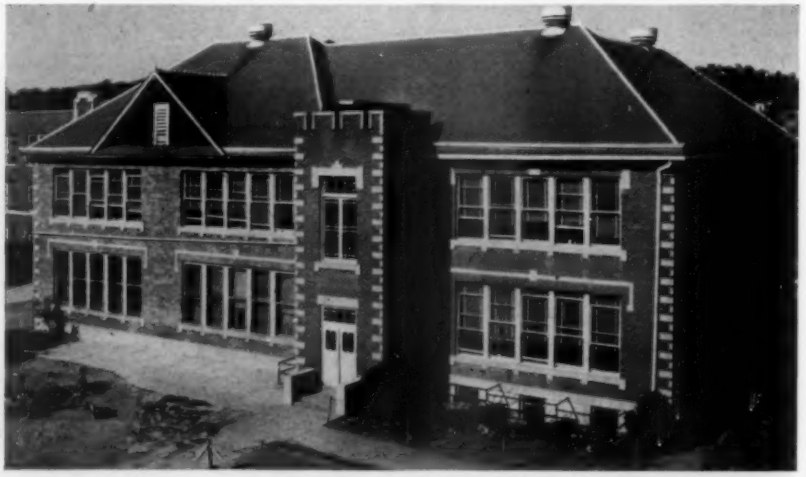
Convenient Source of Supply

The widespread distribution facilities of The Texas Company through the local Texaco Roofing Dealer assure prompt deliveries and helpful cooperation with all roofing problems.

• • •

FOR SAMPLES, COLORS AND SPECIFICATIONS SEE THE NEAREST TEXACO ROOFING DEALER OR WRITE TO THE NEAREST OFFICE OF THE TEXAS COMPANY OR TO THE TEXAS COMPANY, ROOFING SALES DIVISION, 135 E. 42ND ST., NEW YORK, 17, N. Y.

TEXACO — *a name that millions know*



TEXACO — *a name you can trust*

ONE OF MANY SCHOOL BUILDINGS ROOFED WITH TEXACO STRIP SHINGLES
Texaco Asphalt Shingles add beauty and color and years of economical protection

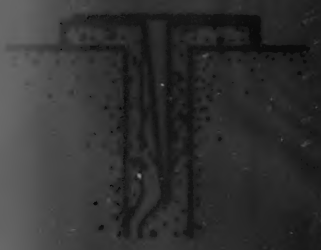
TEXACO ROOFING DEALERS EVERYWHERE East of the Rockies

The Texas Company *District Offices:* Atlanta, Ga. · Buffalo, N. Y. · Chicago, Ill. · Dallas, Texas · Denver, Colo. · Houston, Texas · Indianapolis, Ind. · Minneapolis, Minn. · New Orleans, La. · New York, N. Y. · Norfolk, Va.

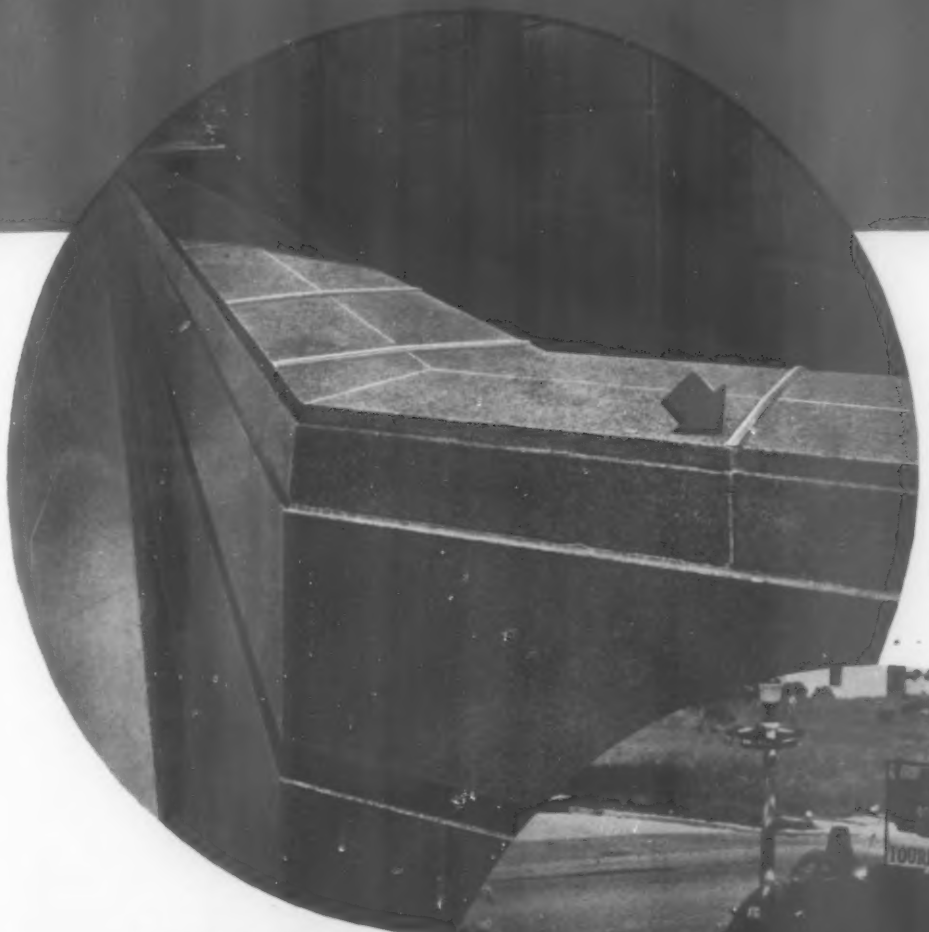
PERFECTION JOINT COVER

1444

An Expanding Metal Protection for Mortar Joints in Masonry



Used in Copings, Cornices, Belt Courses Wall Tables and Sills



Protects
AGAINST FROST AND MOISTURE

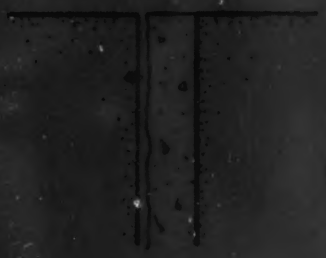
Eliminates
PERIODIC REPOINTING

A PROVEN SAFEGUARD *of* **MAXIMUM PROTECTION** *at* **MINIMUM COST**

DUSING & HUNT INC., BUFFALO, N. Y.

PERFECTION
JOINT COVER

WITHOUT JOINT COVER



a

The unprotected mortar joint will—after the natural expansion and contraction of stone—invariably develop cracks. As an obvious result, not only is the mortar bond broken, but moisture will seep through the crack to saturate the masonry. This condition—especially when followed by frost—will invariably cause constant and increasing damage to the masonry and interiors as well or will demand repeated repainting. To offset this costly condition Perfection Joint Covers were designed.

JOINT PROTECTED WITH PERFECTION

b

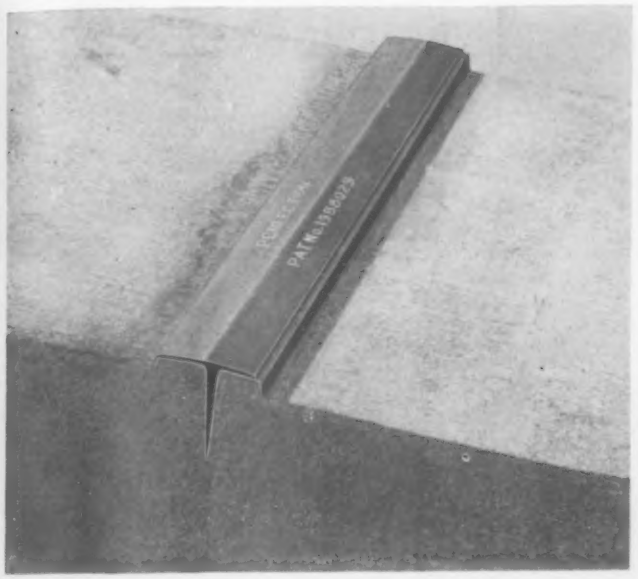
Figure B illustrates how the Perfection Joint Cover formed from one piece of copper is embedded into a typical masonry joint. Note that the mortar, completely protected by the joint cover from all outside evaporation, is permitted to cure slowly and completely and make a perfect bond to the stone. It bonds so completely, that in spite of a 25 pound test pull against the dam formed under the cover, the mortar remained bonded to both stone surfaces. The "test" photos at the right show the solid bed of properly cured and thoroughly hardened mortar that was formed beneath the Perfection Joint Cover.

AFTER CONTRACTION OR EXPANSION

c

In this illustration the stone has contracted and has caused the Joint Cover to expand and the mortar of the joint below the Joint Cover to crack. Both edges of the Joint Cover are held stationary above the dam causing the center of the V form to expand. The top surface of the Joint Cover slides over the copper surface below, which remains stationary and keeps the expanded motar joint fully protected. As a result, even if water is driven under the sliding cover, the one piece construction of the Joint Cover offers a continual protection to the joint.

Perfection Joint Covers



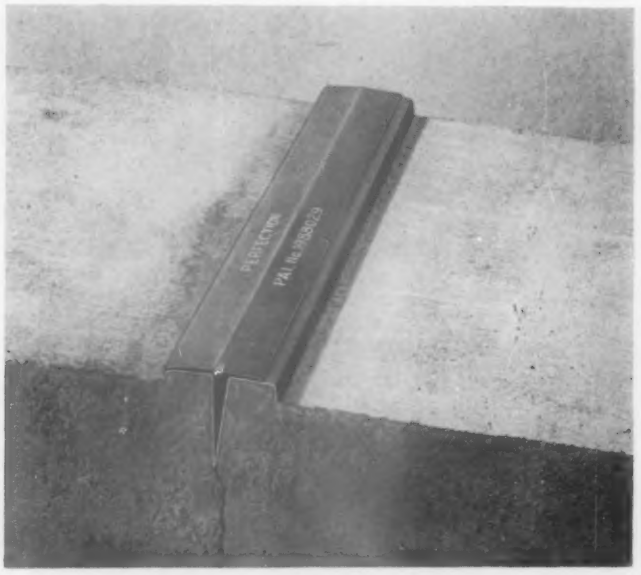


Illustration above left shows joint cover after setting and at right is shown how although contracting stone breaks the joint, the joint cover expands sufficiently to continue to give perfect protection.

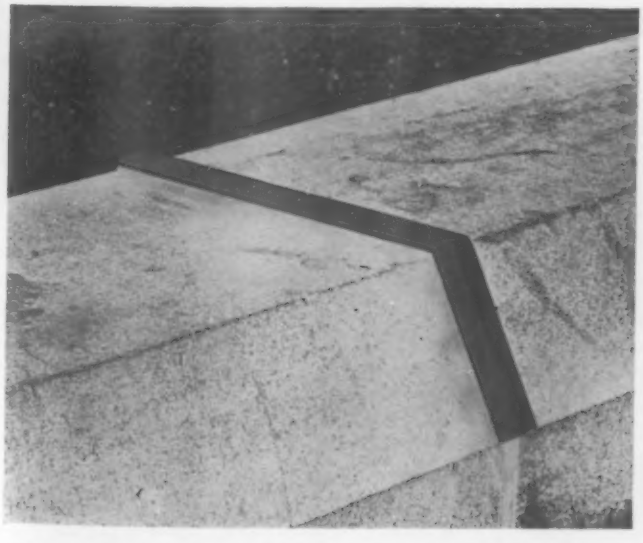
A SIMPLE TEST INDICATING PERMANENT SEAL OF STONE JOINT Due to protection of copper cover a positive mortar bond, as illustrated below, is secured by slow hydration of mortar in joint and under Cover, and allows the bonding qualities of mortar to function.

Close-up of typical stone joint after expansion or contraction of stone takes place.

Typical stone joint mechanically expanded 5/8 in. wide, note how mortar under Joint Cover still remains firmly bonded to stone surfaces even after this extreme movement.

An actual scale test applying 25-lb. pull against mortar dam formed under Joint Cover. Mortar still remains bonded to stone surface.

Shows broken stone joint and depressions in mortar formed by anchor points of Cover. Note how full bed of mortar was formed under the Cover.



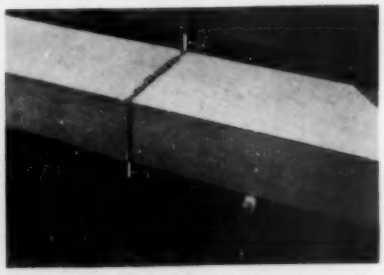
THE AMERICAN SCHOOL AND UNIVERSITY—1945

DUSING & HUNT, INC.

Perfection Joint Covers

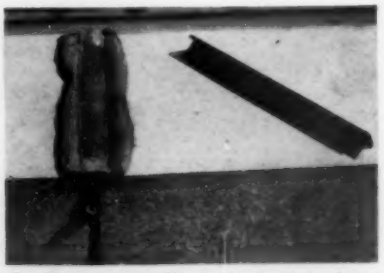
METHOD OF SETTING COVERS (SHORT FORM)

1. Bed stone joint fully with regular mason mortar before setting stone in place.



2. Allow ¼" where stones to be joined meet.

3. Prepare Joint Cover for setting and bed it with mortar.



4. Place Joint Cover into stone joint and press firmly into position. Be certain that the vertical edges of Cover set flush upon the stone surfaces.

5. After Cover is set into position, the excess mortar in the joint and on the Cover will ooze out, indicating a full bed of mortar under the Cover.

6. After the Cover and Mortar set a few minutes, the excess mortar may be removed from the stone surfaces. And if a cover is not furnished for the end joints, those ends should be pointed.

SPECIFICATIONS

Place Under Section for Cast or Natural Stone or Terra Cotta.

The Stone Contractor shall furnish and deliver to Mason Contractor (for setting) upon delivery of stone, Perfection Joint Covers of 12-oz. lead coated copper as manufactured by Dusing & Hunt, Inc., 1927 Elmwood Avenue, Buffalo, N. Y., or equal.

Joint Covers to be of self-centering and self-anchoring type, designed to expand with the shrinkage of the stone and mortar, remain permanently and rigidly anchored into top exposed mortar joints of all copings, cornices, belt courses and multiple sills.

This contractor to supply to manufacturer or their representatives, copies of details of stone showing exact sizes and contours so covers can be supplied to proper dimensions.

Place Under Section for Mason.

This Contractor shall refer to the stone specifications and set all Perfection Joint Covers as furnished and delivered to him by the Stone Contractor.

These joint Covers to be set accurately in accordance with manufacturer's instructions at the time stone is set, and caution should be taken to completely fill joint cover with regular mortar before placing in joint. See manufacturer's written instructions supplied with each shipment.

DUSING & HUNT, INC.

1927 Elmwood Avenue, BUFFALO 7, N. Y.

REPRESENTATIVES IN MUNICIPAL CITIES

PARTIAL LIST OF USERS OF PERFECTION JOINT COVER

SCHOOLS AND UNIVERSITIES

Manhasset Grade School, Manhasset, Long Island, N. Y.
Hampton Street Grade School • Jackson Avenue Grade School
Mineola High School Addition, Mineola, Long Island, N. Y.
Horace Greeley School, Chappaqua, N. Y.
Wellsville Elementary School, Wellsville, N. Y.
Edmeston School, Edmeston, N. Y.
Woodsport School, Woodsport, N. Y.
Central Grade and High School, Wappingers Falls, N. Y.
University of Rochester (Women's Dormitory), Rochester, N. Y.
Canisius College, Buffalo, N. Y.
Purdue University, Lafayette, Indiana
University of Minnesota, St. Paul, Minn.
Mass. Institute of Technology, Boston, Mass.

LIBRARIES

Davenport Public Library, Davenport, Iowa
Sandal Memorial Library, Rochester, N. Y.

CHURCHES

Lutheran Church, Buffalo, N. Y.
St. Paul's Lutheran Church, Martinsville, N. Y.
St. Peter's Church, Steele, Ill.

FACTORY BUILDINGS

Hooker Electrochemical Company, Niagara Falls, N. Y.
National Gypsum Company, Clarence, N. Y.
Upgrade Sylvania Corporation, Emporium, Pa.
Fairmont Creamery, Buffalo, N. Y.
Chevrolet-Tarrytown, Tarrytown, N. Y.
Curtiss-Wright Corporation, Various Plants
Goodrich-Hershey Corp. • Linde Air Product's Corp., Buffalo, N. Y.
Agia-Ansco Co., Binghamton, N. Y.
Genesee Die Casting Co., Batavia, N. Y.
Lexington-Gould Corp., Rochester, N. Y.
Wholesale Market Buildings, Kansas City, Mo.
Buffalo Arms Corp., Cheektowaga, N. Y.
George B. Carter • Fanny Farmer Candy Shops, Inc., Detroit, Mich.
Johnson Wax Co., Racine, Wis.

BANK BUILDINGS

Akron Savings & Loan Assoc., Akron, Ohio
Cleveland Trust Company, Cleveland, Ohio
Morris Plan Ind. Bank, Burlington, N. C.
Fletcher Trust Company, Indianapolis, Indiana
Union Bank Building, Davenport, Iowa

OFFICE BUILDINGS

Sorrell Building • Tiede-Zoeller Tile Co., Buffalo, N. Y.
Burlington Mills Office Bldg., Greensboro, N. C.
Oliver Building • Gulf Building, Pittsburgh, Pa.
Hanna Building, Cleveland, Ohio
New England Life Insurance Co., Boston, Mass.
State of Pennsylvania, Harrisburg, Pa.
National Life Co., Nashville, Tenn.
P L & W Railroad Co., Philadelphia, Pa.

HOTELS

Sutherland Hotel, Cincinnati, Ohio

STORES AND MERCANTILE BUILDINGS

Bolivar Store, Lancaster, N. Y.
Atlantic & Pacific Tea Co., Buffalo, N. Y. and elsewhere
Loblaw Stores, Buffalo, N. Y. and elsewhere
Elmira Park and Shop Building, Elmira, N. Y.
S. S. Dresser Company, Bradford, Pa.
F. W. Woolworth Co. • S. S. Kresge Co., Various Locations
Peck Store, Greensboro, N. C.

HOSPITALS

General Hospital, Kansas City, Mo.
Miller Hospital, St. Paul, Minn.
J. N. Adam Memorial Hospital, Perrysburg, N. Y.
Columbus Hospital, Buffalo, N. Y.

PUBLIC UTILITIES

Pennsylvania Power & Light Co., Harrisburg, Pa.
Rochester Gas & Electric Co., Rochester, N. Y.
Commonwealth Edison Co., Chicago, Ill.
Cincinnati Gas & Electric Co., Cincinnati, Ohio
Illinois Bell Telephone Co., Peoria, Ill.
Niagara Hudson Corp. • Northwestern Bell Telephone Co. • Ohio Bell Telephone Co., Various Locations
Southwestern Bell Telephone Co., Tarrant, Ala.

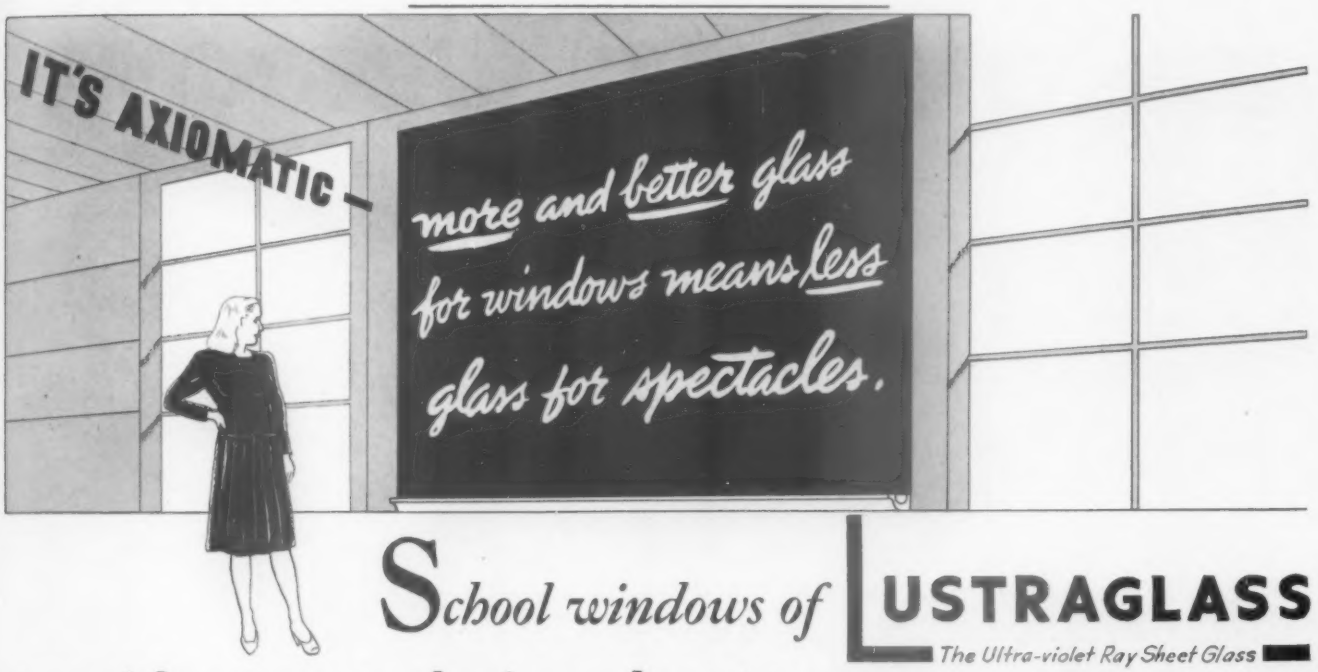
STATE AND MUNICIPAL BUILDINGS

Public Works Building • City Hall, Buffalo, N. Y.
City Building, Coral Gables, Fla.
City Hall, Asheville, N. C.
City Building, Binghamton, N. Y.
Public Works Office (Navy Yard), Washington, D. C.
County Building, Springfield, Ohio
Kenmore Post Office, Kenmore, N. Y.
Dept. Public Bldgs. & Properties, Indianapolis, Indiana
Fire and Police Station, Buffalo, N. Y.
Harrison County Court House and Jail, Bethany, Mo.
Indiana World War Memorial, Indianapolis, Indiana
Fire Station, Middletown, N. Y.
Armory Building, Columbus, Ohio

AMERICAN WINDOW GLASS COMPANY

Manufacturers of Lustraglass, Plexite and Supratest Safety Glass; Lustrablu and Lustragold ornamental glass; Lustra Cover Glass for microscope slides, Armor-Lite Bullet-Resistant Glass; Crystal Sheet, Chipped and Special Glass for Scientific and industrial needs.

Pittsburgh 22, Pennsylvania



School windows of LUSTRAGLASS

The Ultra-violet Ray Sheet Glass

provide many exclusive advantages at no extra cost.

Windows and the glass we use in them are being recognized more than ever as playing a most important part in our daily life. Wherever there is indoor life and activity it is imperative that we let in all the natural daylight possible and that this light be undistorted. This is especially true in the school room where our growing children spend the greater part of each day.

As a result of the demand for more and better light, with less distortion, architects and builders everywhere are insisting on windows of Lustraglass and the many exclusive advantages it provides at no extra cost.

Compared with ordinary window glass, Lustraglass . . .

- transmits more of the ultra-violet rays of sunlight
- is obviously freer from distortion
- has much less of the greenish cast common to other glass used for glazing
- offers a jewel-like luster that enhances the appearance of any building
- and last, but not least, Lustraglass **costs no more.**

Write Lustraglass into your next specification—it has no equal. Ask for free Booklet 4107.

AMERICAN WINDOW GLASS CO.
PITTSBURGH

HOLY NAME GRADE SCHOOL, TOPEKA, KANSAS Glazed throughout with Lustraglass · Architect: Ben H. Byrnes, Salina, Kansas
Contractor: J. H. Casson & Sons, Topeka, Kansas · Glazier: Curtis Companies Incorporated

MICHAEL FLYNN MANUFACTURING CO.

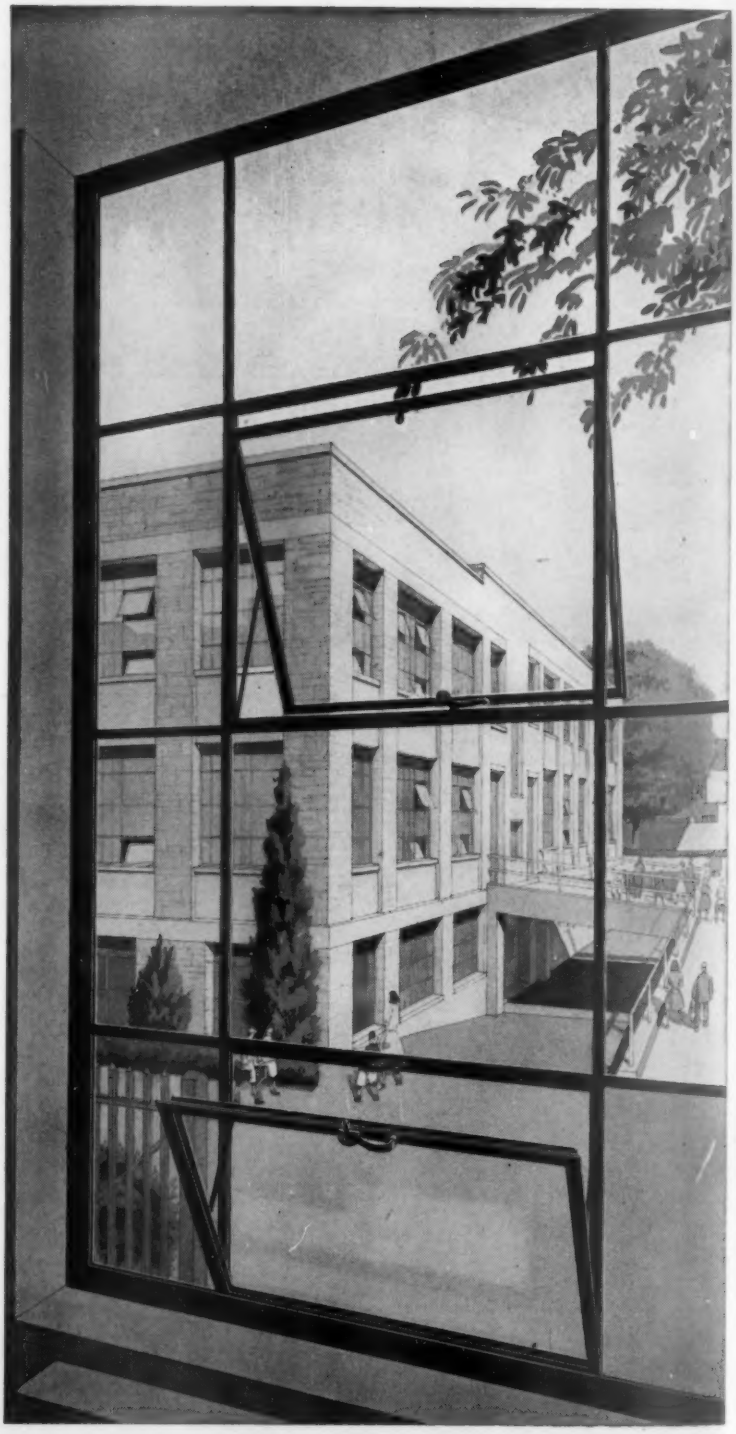
(MEMBER METAL WINDOW INSTITUTE)

E. Allegheny Ave. at Tulip St., Philadelphia 34, Pa.

Manufacturers of Metal Windows, Doors, Skylights, and Window Operating Devices

LUPTON METAL WINDOWS

Lower Merion Senior High School
(Technical Division, Ardmore, Pa.)
Savery Sheetz & Gilmour, *Architects*
Joseph P. Farrell, *Builder*



More light—with Lupton . . .

Extensive research and careful planning have led to increased daylight requirements for schools . . . and Lupton Windows are designed to meet these requirements.

Lupton Metal Windows mean not only more light, but easily controlled ventilation, smooth operation, extreme weather-tightness and low first cost and maintenance.

New Post War Sizes conform with Modular Systems. Write for our new Catalog giving complete information, or see our catalog in Sweet's Architectural file for 1945.

Let Lupton help you plan now! Over forty years' experience in Metal Window Construction!

MICHAEL FLYNN MANUFACTURING CO.
(Member Metal Window Institute)

THE COLUMBIA MILLS, INC.

225 Fifth Avenue, New York 10, N. Y.

Columbia Window Shades and Venetian Blinds

Depend on *Columbia* WINDOW SHADES for Correct Diffusion of Light

Scientifically Made to Cast Abundant Glow of Sunlite while Eliminating Glare

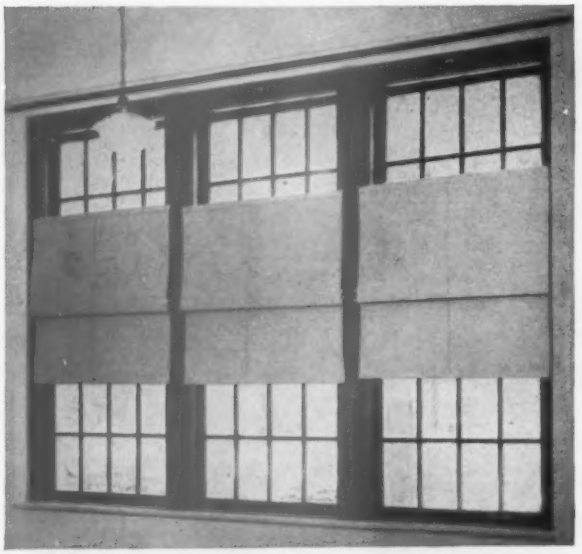
Of paramount importance in the classroom are good, light-diffusing window shades. Correctly filtered sunlight is more restful to the eyes than direct rays . . . helps cut down eyestrain, fatigue and restlessness. Columbia has long specialized in shades that bring in soothing, ample light. Made to stand up to the hard usage of classrooms, Columbia shades are woven of rugged, easy-to-clean fabrics . . . and are made to operate quietly and with long-life efficiency. You will be grateful to the fine service and eye-easing properties of Columbia shades if you specify them for the classrooms in your school.

• • •

Smooth-Operating Columbia Venetian Blinds for School Offices

To add beauty, as well as light and air control, Columbia Venetian Blinds are preferred for most school offices and teacher recreation rooms. Leading schools and universities all over the country are equipped with Columbia blinds in the rooms which need attractive window coverings as well as smooth-operating efficiency. Especially good for offices are Columbia's Controlite blinds with the wide 2⅜" slats and proportionate fittings. You will find Columbia blinds simple and fool-proof, and made so well that you can expect years of good service.

We have been making window coverings for over 50 years. Columbia window shades and Venetian Blinds are sold through dealers who are expert at measuring and installing shades and blinds which will fit perfectly and operate with the utmost satisfaction.



Approved for easiest adjustment. This style directs light where needed most, permits correct ventilation.

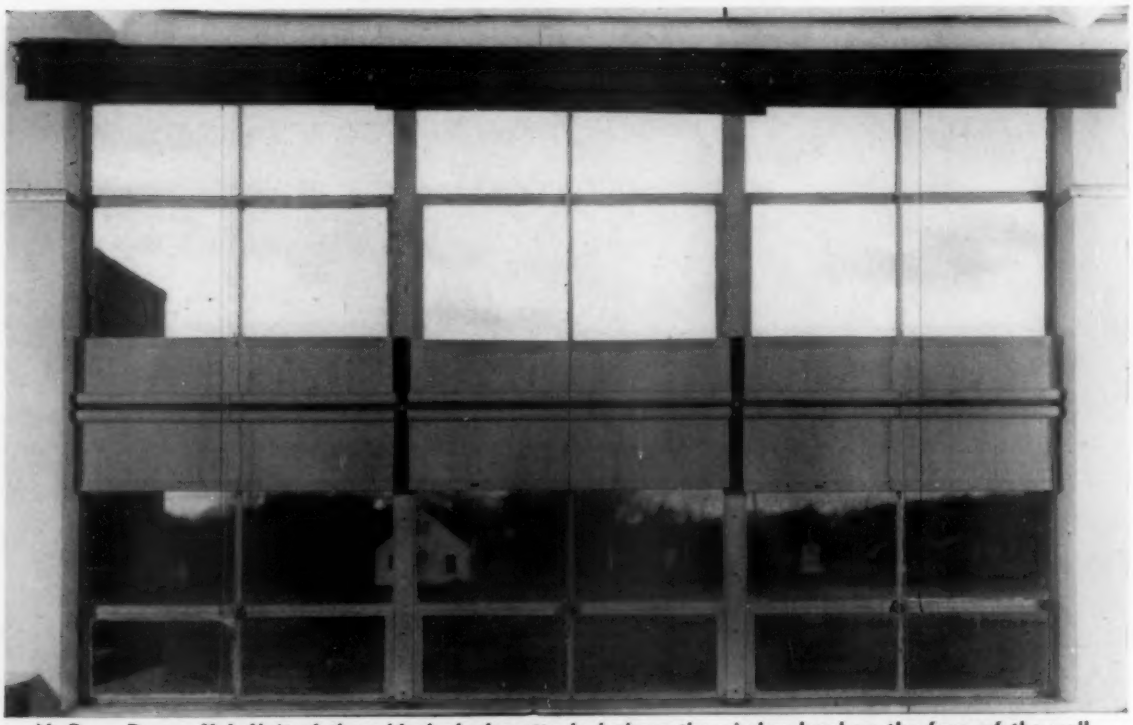
A handsome style for offices, recreation rooms. Mechanism is concealed for greater beauty. Variety of colored tapes available.

LUTHER O. DRAPER SHADE COMPANY

Dept. AS 45

Spiceland, Indiana

Modern Classrooms should be carefully planned for use of both Translucent and Darkening Window Shades



N. B. — Draper X-L Unit of three black shades attached above the window head on the face of the wall.

The window in above photograph with bay of steel sash has translucent Double Roller Shades Demountably applied: (1) by rigid V shape roller supporting light shield, easily removable by lifting pin at each end of V shield; (2) by the Draper Pulley Bracket which freely and solidly supports the pulley of the upper shade. Draper furnishes the fixtures complete for mounting the shade properly. Sash manufacturer delivers the sash with the holes punched in the proper location (**no drilling on the job**) if specified.

With clear wall space at the top and the sides of the window (no moldings, pipes or partitions to interfere) the Draper X-L unit of Black Shades is easily mounted to the wall or, if wall space above window were not available, the inverted L shape bracket shield attaches to the ceiling. These Visual Education Darkening Shades have no connection to the window sash and exclude the light on the simplest principle of cloth overlap one shade on another and over the wall beyond the window jambs. There is no limit to shade width on this principle. No fixtures except the novel roller brackets which are in combination with the inverted L shape shield across the window head.

On wood frame windows the application of the two complete sets of shades can be the same in principle as shown for steel sash.

Gymnasium-Auditoriums are used for visual education. Keep wall space around the window openings clear for overlapping shades. Avoid any mechanical sash operators, window guards or fixtures that project into the room. A clear flat wall space of at least 8 inches beyond the sides of the window opening and to the front of the wall line at the window head should be provided. This cooperation by the Architect and the sash manufacturer is valuable consideration to the use of the building. Write for full information.

Provide All Windows for Use of Darkening Shades

Draper Demountable Translucent Shades are readily taken down for replacement (both shades using the same pulley bracket) with the Draper Detachable Pakfold Black Shade. The Portable Pakfold may be used in different rooms—no roller or springs, can not get out of adjustment. Information on request.

THE KINNEAR MANUFACTURING CO.

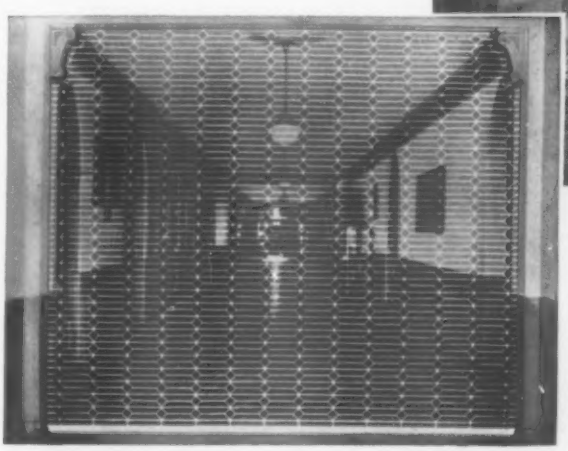
PLANTS: COLUMBUS 16, OHIO, 1760-80 Fields Ave. — SAN FRANCISCO 24, CALIF., 1742 Yosemite Ave.

Manufacturers Exclusively of Rolling Doors and Grilles

PRODUCTS—Wood or Steel Rolling Service Doors, Automatic Fire Doors and Shutters, Metal Rolling Grilles, Wood Rolling Partitions and Wood or Steel Upward-Acting Doors.

GENERAL—The Kinnear Manufacturing Company pioneered and have devoted their entire effort for the past 45 years to rolling or Upward-Acting type Doors and Grilles. They have established the reputation throughout the world as specialists in doors that save floor and wall space, operate more conveniently, reduce maintenance expense through unusual durability and that can be built for old or new buildings for inside or outside use.

Kinnear Motor Operated Rolling Service Door — Wood or Steel



Metal Rolling Grille for Inside or Outside Use

Permanently installed but may be rolled up out of sight. When closed, admits air, light and vision. Also, if desired, may be locked to prevent raising.

Automatic Fire Shutters for Doors or Windows

ROLLING DOORS—Kinnear Rolling Doors are composed of either a flexible wood or metal curtain which coils above the lintel, similar to a window shade. They can be installed either on the face of the wall or between the jambs when concealment of the mechanism is desired. Springs provide perfect counterbalance. They can also be operated manually, mechanically or electrically. Built of the finest materials and to high manufacturing standards they give years of dependable service.

METAL ROLLING GRILLES—Operating on the same principle as the Rolling Door, the Kinnear Rolling Grille is a permanently installed and attractively designed barrier that is remarkably strong when closed and locked, but out of sight when opened. When down, it admits air and light, and does not obstruct vision, making it particularly applicable to all types of interior and exterior openings as well as hallways in school buildings. The grille proper is of remarkable strength and artistically designed of steel bars spaced close enough to prevent the admittance of large projectiles or a man's hand. For locking in closed position a lock is furnished. The Kinnear Rolling Grille may be mounted on the face of the wall with brackets and coils entirely above the bottom of the lintel and with edges of guides flush with the face of opening jambs; or where headroom is limited and grille cannot be installed on the face of the wall it may be mounted in the opening.

AUTOMATIC FIRE DOORS AND SHUTTERS—Kinnear Fire Doors, though suitable for service purposes, are "labeled" and equipped with mechanism for automatic closure in case of fire. They are suited for installation in outside or inside door or window openings and in general construction, operation and mounting are similar to Steel Rolling Service Doors. To insure maximum fire protection they are equipped with an auxiliary push-down spring to insure positive closure; a governor for controlling speed of curtain closure; auxiliary hood to protect counterbalance mechanism; and other features in excess of the requirements of the Underwriters' Laboratories. Their superior design has proved its worth in many major conflagrations.

BRANCH OFFICES

Boston, New York, Philadelphia, Washington, New Orleans, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, San Francisco, Baltimore

AGENTS IN ALL PRINCIPAL CITIES

KINNEAR ROLLING DOORS

THE SANYMETAL PRODUCTS CO., INC.

1702 Urbana Road, Cleveland 12, Ohio

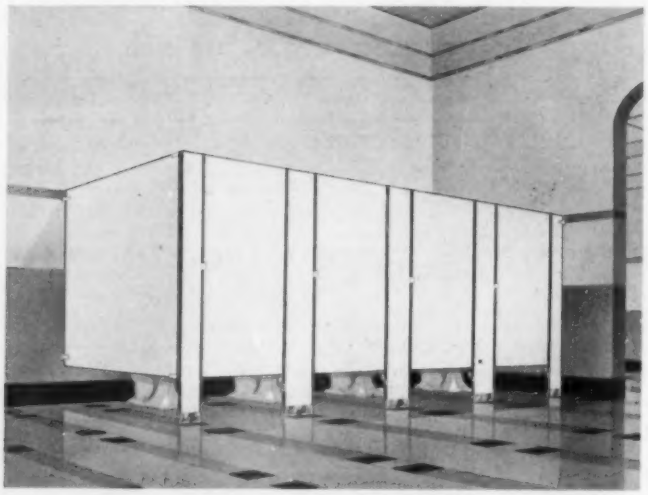
*Sanymetal** TOILET COMPARTMENTS

● The Sanymetal Products Co., Inc., offers six different types of toilet compartments suitable for educational buildings. They are designed and built by Sanymetal specialists with over 30 years' experience in making over 60,000 installations, and embody convenience and sanitation in a degree unappreciated and unapproached, and usually overlooked by those lacking Sanymetal's long experience in this line. Sanymetal engineers and craftsmen were the first to detect the need for, and apply successfully, the merits of porcelain enameled metal in the manufacture of toilet compartments in a manner which is promoting a renaissance in toilet room environments.

Sanymetal Toilet Compartments combine simplicity of design with sound mechanical construction in order to provide a rigid and durable installation, free from dirt-collecting pockets and ledges, and easy to keep clean. Their design and materials impart refinement and cheerfulness, and elevate the toilet room into keeping with other appointments of the building.

Nowhere in a school building are unwholesome tendencies more easily evident than in an unclean, outmoded toilet room, which may unconsciously influence children to assume a careless attitude toward such matters and encourage obscenity. For this reason Sanymetal Toilet Compartments stress modernity and beauty, combined with utmost cleanliness, good taste and orderliness . . . creating a wholesome environment and making a favorable impression upon youth.

Three of the six Sanymetal Toilet Compartments described here are particularly suitable for school and institutional buildings because they are built to stand up against the abusive treatment often accorded to such equipment.



NORMANDIE TYPE TOILET COMPARTMENTS

● A streamline effect is moderately imparted to a toilet room environment when Normandie Type Toilet Compartments are installed. Pilaster tops on the same horizontal plane as the tops of Partitions and Doors give the true streamline effect.

Through skillful Pilaster design and construction and manner of fastening Pilasters to the floor, a degree of rigidity is obtained that is fixed and permanent.

Normandie Type Toilet Compartments consist basically of just three units: Pilasters (flush front), Partitions and Doors (flush type, fully insulated); a simple, mechanically correct construction. They will be available for post-war installations in the following finishes: (1) "Porcena" (porcelain on steel); (2) "Tenac" (baked-on-paint enamel finish over galvanized, bonderized steel); (3) Baked-On Paint Enamel finish over regular furniture finish, cold rolled steel.

*Sanymetal** Porcena (Porcelain on Steel) Toilet Compartments

TO BE SURE OF STRICTLY MODERN TOILET ROOM ENVIRONMENTS IN POST-WAR SCHOOL BUILDINGS USE THIS AGELESS MATERIAL, SANYMETAL PORCENA (PORCELAIN ON STEEL)

● SANYMETAL PORCENA (Porcelain on Steel) presents a correct combination of these desirable qualities: The hardness of glass and the strength of steel. This ageless and fadeless material, Porcena (Porcelain on Steel) provides the utmost in sanitation, a certain elegance and beauty that is otherwise unobtainable, and protection against obsolescence.

SANYMETAL PORCENA (Porcelain on Steel) Toilet Compartments are particularly appropriate for installation in educational buildings as their sturdiness and ageless finish withstands shocks and hard usage without injury to the smooth lustrous surface. It is impervious to odors, moisture, ordinary acids, oils and grease, and is rust-proof. It is as easy to keep clean as wiping the kitchen range, as the finish is non-porous and flint-hard. It discourages the common inclination to disfigure toilet room equipment.

SANYMETAL PORCENA (Porcelain on Steel) Partitions and Doors are Flush type, insulated, and approximately 1 inch thick. Each partition panel and door is formed by assembling two sheets of porcelain finished steel to a rigid, dense, sound-deadening ⅞ inch insulating core. Thus, a partition panel or door is formed *that greatly exceeds the usual resistance to damaging blows,* of other materials commonly used for toilet compartments.

SANYMETAL PORCENA (Porcelain on Steel) Partitions and Doors should never be confused with ordinary single sheet steel panels and doors. Sheet steel of special composition for vitreous enameling is used.

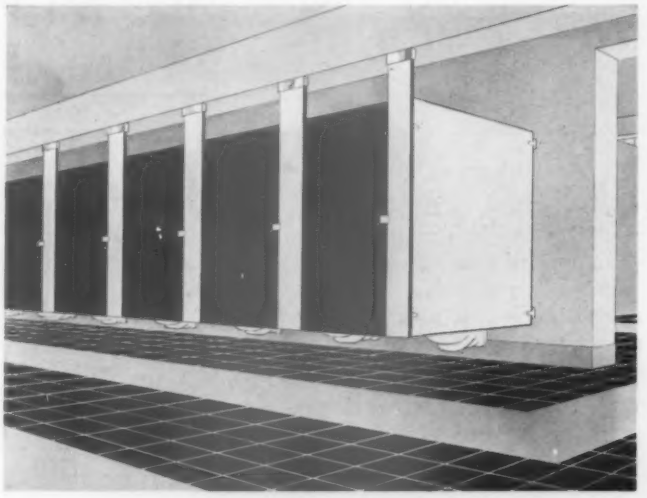
When planning buildings to be constructed in the post-war period, be sure to avoid specifying any material that may become obsolete due to the introduction of new materials and designs. Sanymetal Porcena (Porcelain on Steel) is indeed the ageless material that always stays new.

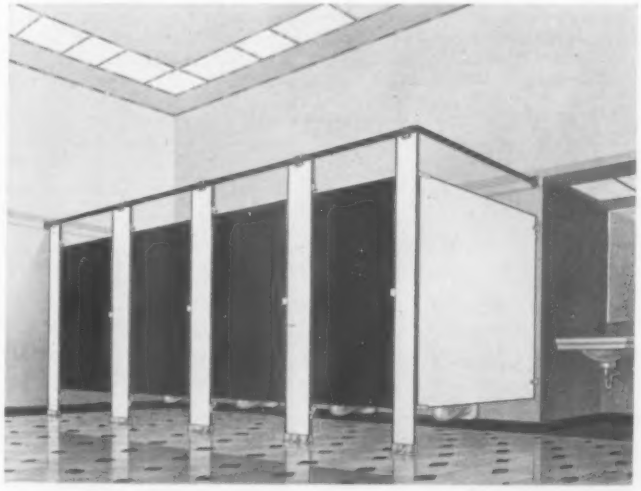
* Trade Mark Reg. U. S. Pat. Off.

CENTURY TYPE CEILING HUNG TOILET COMPARTMENTS

● Sanymetal Century Type Ceiling Hung Toilet Compartments provide an element of modernity and utility, combined with utmost cleanliness, that gives long time assurance against obsolescence. They are as modern as will be the schools of tomorrow. Strikingly new in design, finish and construction, they elevate the toilet room environment into harmony with other modern appointments of school buildings.

Sanymetal Century Type Ceiling Hung Toilet Compartments are available in three finishes: (1) "Porcena" (Porcelain on Steel); (2) "Tenac" (baked-on paint enamel finish over galvanized, bonderized steel); (3) Baked-on paint enamel finish over regular furniture finish, cold rolled steel.





ACADEMY TYPE TOILET COMPARTMENTS

● There's a certain refinement and distinctiveness about an installation of Academy Type Toilet Compartments, that produces a wholesome atmosphere in school toilet rooms. With Flush Pilasters extending well above the doors and partitions, and united with an overhead brace of modern design, this type of compartment is the only one in which all of the dignity and distinctiveness of flush type construction, unmarred by posts, is appropriately combined with the headrail. Pilasters replacing posts and extending well above the Doors and Partitions, are flush type insulated panels. They present a flat, smooth surface on both sides that is easy to clean.

Sanymetal Academy Type Toilet Compartments are available in three finishes: (1) "Porcena" (porcelain on steel); (2) "Tenac" (baked-on paint enamel finish over galvanized, bonderized steel); (3) Baked-on paint enamel finish over regular furniture finish cold rolled steel.

A SPECIALIZED ENGINEERING SERVICE—Ready to Serve You

● Begin now to plan toilet room improvements. Be ready to act promptly when wartime restrictions on fixtures and materials are removed. Neglect of toilet room environments means neglect of the health and welfare of children. School officials should consult an architect for guidance in developing a modern toilet room environment that will make a favorable impression on impressionable youth.

Out of an experience extending over a period of thirty years, Sanymetal offers a specialized technical service to architects and engineers for the purpose of laying out difficult toilet room installations for school and other buildings. The purpose of this service is to facilitate the laying out of installations and in no way encroaches upon the exercise of creative talents by architects in developing modernity and elegance in toilet room environments. Backed by thousands of blueprints on file, this phase of Sanymetal Service may be used to reduce time. Requests for specialized technical service should state the size of the toilet room, the approximate number of toilet compartments required, and, if possible, the type of installation contemplated.

A commendable procedure is to first consult the Sanymetal Representative in your locality (listed under "Partitions" in your phone book). His experience is broad and covers many different conditions arising in schools all over the country. If that is not possible, then write direct to the factory, at Cleveland, Ohio.

OTHER SANYMETAL PRODUCTS FOR SCHOOL AND EDUCATIONAL INSTITUTIONS

● Sanymetal provides a wide range of accessory equipment for furnishing toilet and washrooms in school and educational buildings. In addition to Toilet Compartments, these products include: Shower Stalls; Shower Cabinets, Several Types; Dressing Room Compartments; Utility Enclosures; Entrance Screens; Janitors' Closets.

* Trade Mark Reg. U. S. Pat. Off.

THE SANYMETAL PRODUCTS CO., INC.

1702 URBANA ROAD, CLEVELAND 12, OHIO

THE LOXIT COMPANY

605 West Washington Boulevard, Chicago 6, Illinois

THE LOXIT SYSTEMS

GENERAL INFORMATION

The LOXIT SYSTEMS lay, set, and suspend by mechanical means, building materials and accessories such as flooring, acoustical tiles and slabs, blackboards, trims, etc., usually nailed or screwed on or applied with adhesives.

In principle the LOXIT SYSTEMS are designed so as to either control or compensate for expansion, contraction, and settlement in buildings. The mechanical parts of the LOXIT SYSTEMS interlock—giving LOXIT its name.

No special tools are required. Any good mechanic can learn to use any of the LOXIT SYSTEMS in a few hours' time.

The LOXIT SYSTEMS, being mechanical, assure uniformity, flexibility, and permanence in a job that is not readily attainable with common and less certain methods, using nails or adhesives for fastening or holding together the materials.

UNIFORMITY:—Uniformity is a quality that is inherent in mechanical systems as it means the putting together of the various parts involved in the system thru means, devices, and procedures that are designed and manufactured to be always used in the same way, assuring a sameness in the results that cannot be obtained by unmechanical means.

FLEXIBILITY:—Flexibility is another of those qualities that is inherent in mechanical systems because it permits the taking down or apart and the putting together again of the various elements that compose that system. Adjustments can be made for settling, shrinkage, and even for expansion and replacements or repairs that would not be possible otherwise. This flexibility is not available to materials put together with nails or adhesives as the materials themselves are destroyed or more or less damaged when they are taken apart, with the result that they cannot be reused or only a small portion can be.

PERMANENCE:—While permanence has been achieved and is possible with the ordinary ways of putting materials together, greater permanence with the added advantage of uniformity and flexibility almost always is an assurance when using mechanical methods in the execution of the job, because a usually tighter job and a usually better executed job can be obtained by mechanical means.

MAINTENANCE:—It should be apparent that the cost and efficiency of maintenance is directly related to the quality of the job to which it is applied. Therefore maintenance is greatly reduced both in labor and cost when the completed job is uniform, flexible, and permanent. These qualities are inherent in mechanical systems and therefore assure better maintenance conditions.

THE LOXIT SYSTEMS

I. LOXIT Strip Floor Laying System.
II. LOXIT Acoustical Tile and Slab Laying Systems:
- Type 1. A—Using straight edged materials laid with matched joints, fireproof construction.
- B—Using straight edged materials laid with staggered joints, fireproof construction.
- C—Using straight edged materials laid with matched joints secured to wood furring.
- D—Using straight edged materials laid with staggered joints secured to wood furring.
- Type 2. Using kerfed materials.
- Type 3. For resetting materials that have been nailed or glued to ceilings and walls, and have become loose.

All of these systems can be used for both suspended and directly applied materials. Types 1 and 2 can also be used with Loxit suspension clips—giving any depth of suspension wanted without pencil rods, furring or other suspension members.

III. LOXIT Spring Type Blackboard Setting System.
IV. LOXIT New Improved Inclined Chalk Trough.
V. LOXIT Interlocking Metal Shims.
VI. LOXIT Storage Racks—for materials in long lengths.
VII. LOXIT Metal Trim, Moulding, Thresholds and Stair Nosings.

THE LOXIT FLOOR LAYING SYSTEM

View of floor of Patten Gymnasium, Northwestern University, Evanston, Ill., while being laid. Holabird & Root, Architects. R. C. Wieboldt, Contractor

A PROVEN, ECONOMICAL SYSTEM FOR ALL TYPES OF BUILDINGS—The Loxit system is a simple mechanical method for laying ordinary T&G strip wood flooring without nails, wood sleepers, or adhesives. It consists of:

(a) A metal channel 1⅛ in. wide by 5/16 in. high with overlapping top edges, punched 4 in. o. c. for fastening.

(b) Uniquely designed clips to be used in laying and locking the floor boards together and to the channels.

ADVANTAGES OF THE LOXIT SYSTEM—

1. Total overall thickness of a Loxit laid floor including 13/16 in. flooring is 1⅛ in.

2. Floor can be laid without expansion joints as the Loxit system limits expansion.

3. Loxit floors can be laid tight, in fact the tighter the better, provided the usual precautions as to building conditions and acclimatization of the flooring have been taken, thereby securing a tight floor to start with.

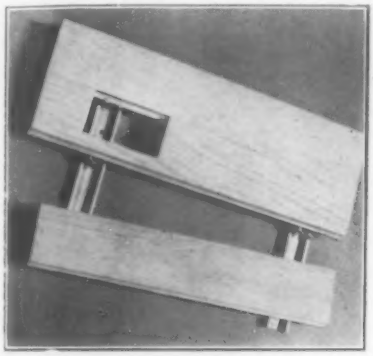
4. Excessive shrinkage, repairs, and replacements can be easily and economically handled when floors are laid with the Loxit system because they can be taken up and re-laid without waste other than new clips.

5. Squeaks in wood floors are caused by vertical movement. When Loxit channels are properly shimmed and grouted and the flooring securely locked into place in accordance with instructions, vertical movement is eliminated and squeaking avoided.

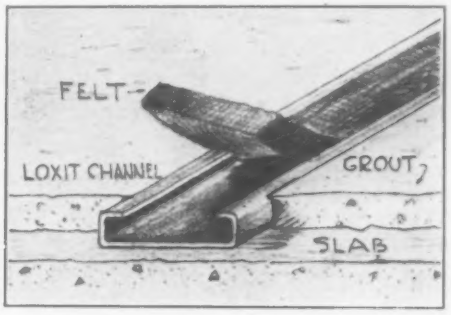
6. Floor may be satisfactorily laid in basements and other areas where other types of wood flooring could not be used by following the simple precautions that are necessary under such conditions.

7. Loxit laid floors require only light sanding.

8 No special milling is required. All flooring milled in accordance with the gauge adopted by the hardwood flooring manufacturers' associations can be used.



Close-up detail showing LOXIT channels . . . clips in place



Detail showing LOXIT channels grouted. Felt is used to keep channels clean

Detail showing close-up of clip and method used to lay flooring

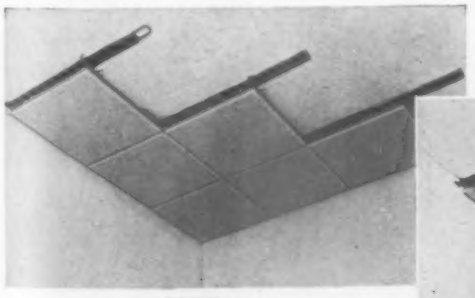
LOXIT ACOUSTICAL SUSPENSION SYSTEMS

If you have an acoustical tile suspension problem you will find the solution in one or a combination of the Loxit suspension methods available for use with straight edged or kerfed tiles and slabs, applied directly to ceilings, walls, beams, ducts, etc., or suspended. There are three types of Loxit acoustical systems:

Type 1—Straight edged tile system.
Type 2—Kerfed tile system.
Type 3—Surface applied system.

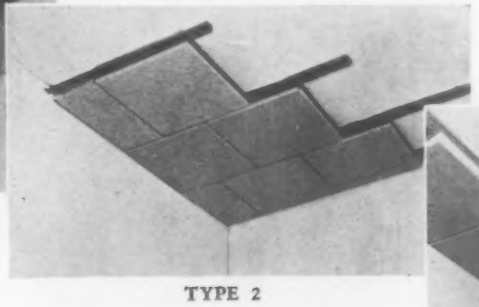
VERSATILITY OF THE LOXIT SYSTEM—In no other system can the architect or acoustical contractor find the solution to all of their acoustical problems when using tiles and slabs kerfed or straight edged with matched or staggered joints applied directly to wall surfaces and ceilings or suspended.

We do not know of an acoustical tile and slab condition that cannot be solved with the Loxit system.



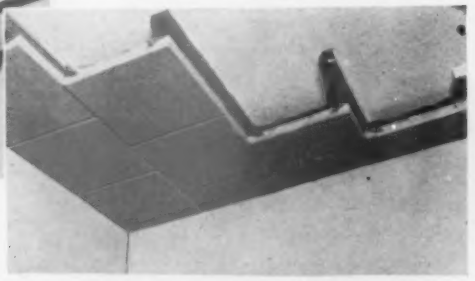
TYPE 1

This system is designed to be used with straight-edge tile, using LOXIT channel and slips that bite into the edge of the tile



TYPE 2

Type 2 **(at left) is the LOXIT kerfed tile system, using LOXIT channel and a series of hemmed splines and strips that fit into the kerfs of the tiles, interlock at the corners, and by means of special LOXIT clips suspend the tiles from the channel. Splines and strips also act as breathing stops**

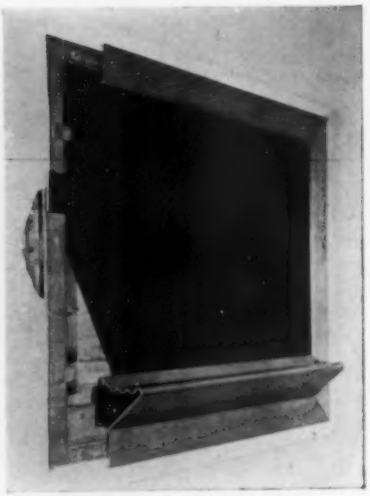


TYPE 3

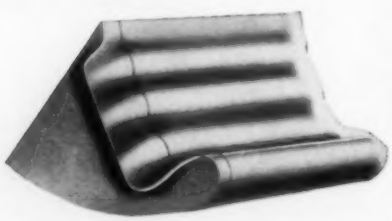
Type 3—**Type 3 is a unique system composed of Loxit V strips, crosses, tees, and ells, specially designed to re-set acoustical tiles and slabs in existing installations that have become loose or for the setting of tiles and slabs directly to ceilings and walls by the use of a surface setting method which forms a wall or ceiling pattern at the same time acts as a positive breathing stop. Particularly adaptable to plastered ceilings. This system is available in primed steel sections ready for painting and in stainless steel.**

In using this system acoustical tiles and slabs not originally mechanically suspended become permanently fixed in place providing against any further movement or breathing.

LOXIT ALL-METAL BLACKBOARD AND CORKBOARD MOUNTING SYSTEM



Loxit blackboard mounting system in place showing construction



Detail showing new LOXIT inclined chalk trough

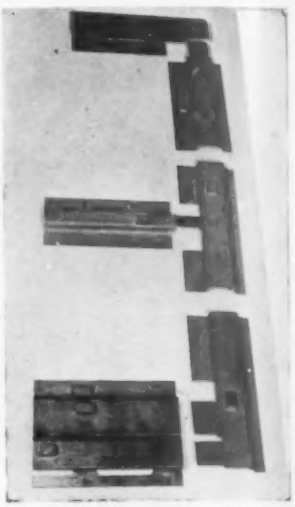
The Loxit system is more than just a ground or trim. It is a complete system combining a plaster ground with snap-on trim, including keys, springs, inserts, and clips to receive and hold the boards and trim, as self-contained units.

The system is designed to provide the maximum amount of adjustment, to assure rapid, economical and perfect installation and to maintain the permanent positions of the various parts after erection through automatic cushioning of the boards against reasonable contraction, expansion, settlement, etc.

ERECTION

It is so simple in principle and construction that any good workman can install it with ease and perfection. All grounds are drilled, slotted, and mitred at the factory to board dimensions shown in drawings, ready to set in place. Special alignment braces are provided for all corners, tees, and joints, making the setting of grounds easy and the placing of trim neat and true.

The Loxit system can be used with any type and thickness of board from $\frac{1}{8}$" to $\frac{3}{8}$", the adjustment for variations in thickness being automatic.



Detail showing ground

ACCESSORIES

Loxit fittings such as map hooks, paper clips, roller brackets, cork inserts, and their combinations are available for every purpose. They are designed to give a maximum freedom of movement and adjustment. They can be placed in and taken out from any point in the Loxit display rail; will slide freely into any position and cannot fall out, as a lower and upper groove automatically hold them to the rail.

LOXIT MOULDINGS

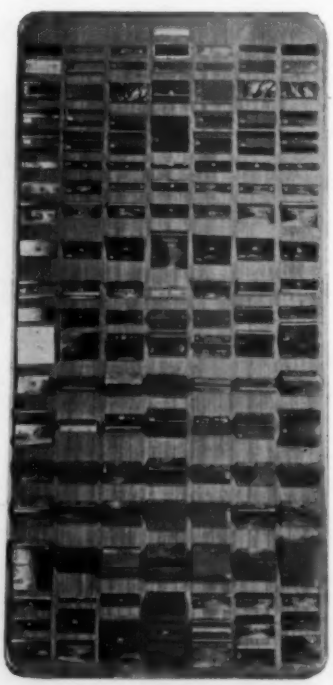
In normal times the Loxit Company carries in stock the most composite stock of metal trim mouldings and thresholds in the world—more than 1200 different designs—in aluminum, brass, stainless steel, metal-covered wood, primed and unprimed steel, etc.

LOXIT metal mouldings and metal trims are available for all of the building trades including interior decorating; display fixtures; cabinet, table and counter facings and trims; floor and wall covering trims; picture frames, bulletin boards, etc.

BENDING

The Loxit Company

We are prepared to bend stair nosings, thresholds and other mouldings to dimensions or templates to suit the job. Unusual problems are especially solicited.



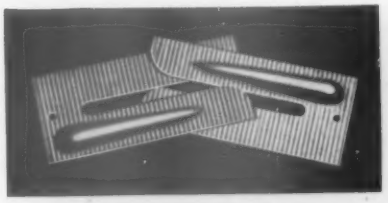
SPECIAL MOULDINGS

While we are prepared to execute specially designed time sections on order at the same comparative costs as our standard sections, we recommend, of course, that our standard sections be used if at all possible, as they were adopted only after the most careful studies of all of the problems involved for the purposes for which they were designed.

We maintain, however, an industrial design service that is available for the study of trim requirements not covered by our standard sections. We therefore invite your inquiries in this field. **When in need of mouldings, ask LOXIT.**

LOXIT INTERLOCKING METAL SHIMS

Use **LOXIT Interlocking Metal Shims** for furring strips, floor sleepers, window and door jambs, joists, and other construction items requiring leveling and shimming.



3 gauges: 28, 22, 18

HERE IS HOW THEY WORK

Place Loxit shim on each side of the work that is to be shimmed after fastening same. Shove them together inserting plain leg under crimped leg so as to form the inter-lock. Knock them towards each other as far as necessary to obtain level wanted and drive tight. Slots are provided so as to straddle the nail used in fastening materials to be shimmed providing equal shimming on each side of point of bearing as well as on each side of material.

ADVANTAGES

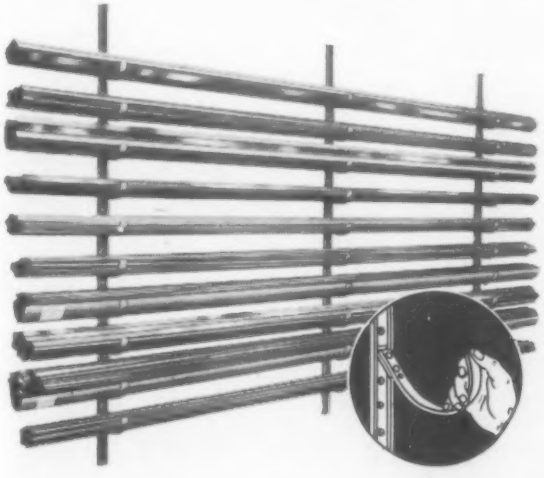
Loxit shims save time and trouble. There is NO WASTE and NO SHRINKAGE as with ordinary wood wedges or shingles.

LOXIT STORAGE RACK

Saves Space! Preserves Stock!

USES OF LOXIT STORAGE RACK

Pipe
Tubing
Bars
Flats
Angles and other shapes
Mouldings



Projects only 5⅝″ from the wall. Every piece of material is easily accessible. An inventory can be taken in a few minutes. Danger from damage and waste is greatly reduced. Available storage space is multiplied many times.

SPACINGS ARE ADJUSTABLE

In length and height of stand.
In distance between rows of brackets and between standards.
Brackets for special uses on order.

By adding standards horizontally, racks can be any length. . . . By adding to standards vertically, racks can be any height. . . . By spacing standards closer, additional materials can be carried. . . . By spacing brackets closer more numbers can be separately and conveniently stocked. . . . By using special brackets, additional uses are made available. . . .

LITERATURE AND SPECIFICATIONS—Complete Loxit catalogs describing in detail the various Loxit systems and accessories including full sized details, scale drawings and specimen specifications are available upon request.

The Loxit COMPANY

TECHNICAL SERVICE — A staff thoroughly trained in the building business is at the disposal of architects and contractors for the study of unusual problems. This service is offered without obligation. Please consult us.

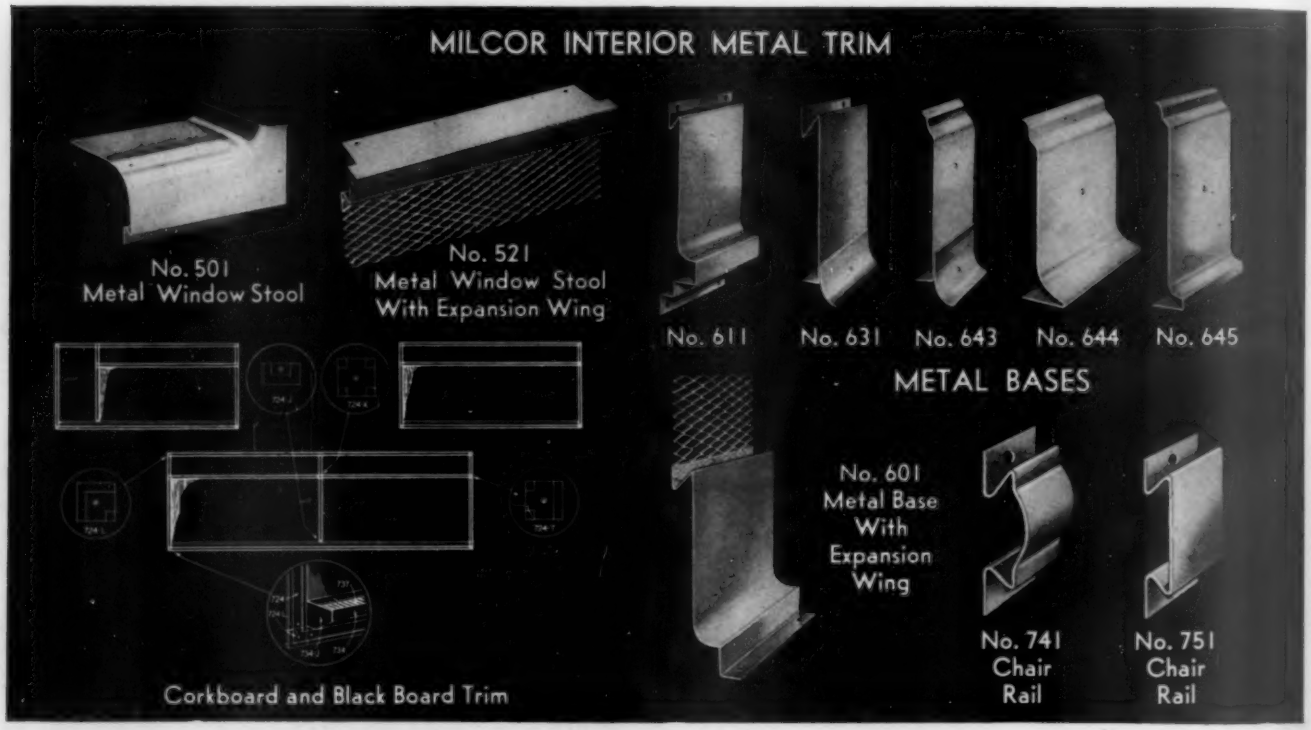
605 West Washington Blvd., Chicago 6, Illinois

MILCOR STEEL COMPANY

4153 West Burnham Street, Milwaukee, Wisconsin

Chicago, Illinois · Kansas City, Mo. · Rochester, N. Y · New York City · Baltimore, Md.

THESE MATERIALS ARE NOT AVAILABLE WITHOUT PRIORITY UNTIL POSTWAR



METAL TRIM OF UNSURPASSED BEAUTY AND DURABILITY NOW AVAILABLE WITH INSULMAT SOUND DEADENING

Milcor Metal Trim is the finest interior trim available for modern school construction. Permanence, fire-safety, and resistance to abuse are a few of the reasons why this line has been specified in representative school construction in all parts of the country. Its attractive appearance and exceptional sanitation make it especially adaptable to school use. Every desirable type of interior trim may be found in the complete Milcor line.

The Expansion Wing, which is an optional feature of many Milcor Metal Trim products, provides a permanent plaster bond, preventing checking and cracking of plaster at vulnerable points. And in schools, especially, it is desirable to preserve the original plastered surface.

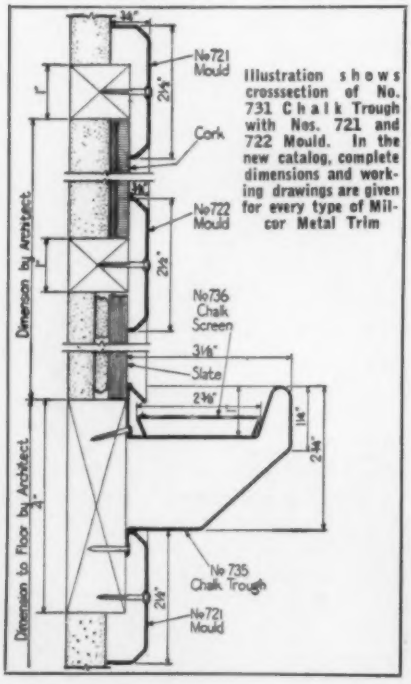
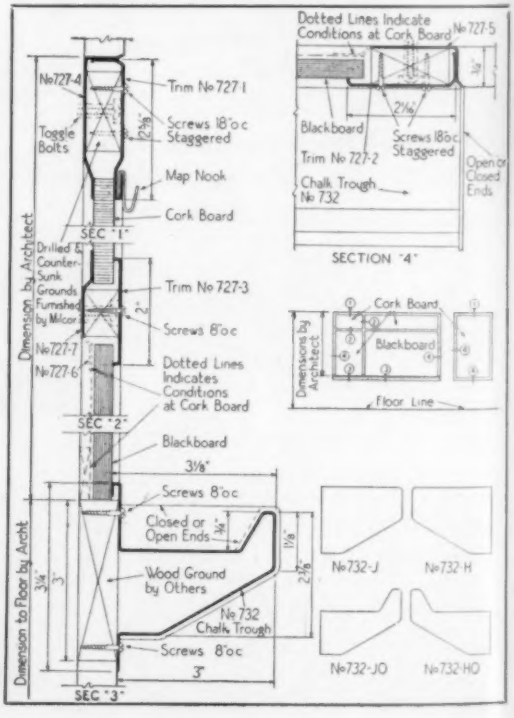


Illustration shows crosssection of No. 731 Chalk Trough with Nos. 721 and 722 Mould. In the new catalog, complete dimensions and working drawings are given for every type of Milcor Metal Trim

Illustration at right shows cross-section view of No. 727 Series Cork Board and Blackboard Trim

Write for the 100-D Milcor Metal Trim Catalog—also for data on Sound Deadening

- **METAL BASES**
- **METAL COVE MOULDS**
- **METAL CHAIR RAILS**
- **METAL BLACKBOARD MOULDS**
- **METAL CHALK TROUGH**



MILCOR PRODUCTS FOR SCHOOLS

MILCOR VENTILATORS

The Milcor "Spinner" Ventilator has great exhaust capacity. The slightest breeze keeps it operating efficiently. As the head revolves, the air in the ventilator is expelled creating a vacuum which draws the impure air from the building.

The Milcor Nu-Alpina Ventilator is an actual "air siphon," utilizing natural wind currents to draw unpleasant, impure air from the inside of a building. With its revolving head suspended on a ball-bearing pivot, the Nu-Alpina is as sensitive as a feather to every change in wind direction. The vane at the top of the ventilator is caught by the slightest motion of air, swinging the revolving head so that its opening constantly faces away from the wind. Air motion past the end of the flue creates a natural vacuum, drawing out impure air and preventing down-draft regardless of wind direction.

Send for literature describing and illustrating Milcor Ventilators

Milcor Spinner Ventilator (above)

Milcor Nu-Alpina Ventilator (right)

MILCOR FIRE-PROOF BUILDING MATERIALS

There is no better plaster base for walls and ceilings of school buildings than metal lath. Its scientifically designed mesh gives it a positive plaster grip. There is no plaster waste with this lath, and yet every inch of wall surface is locked permanently into place.

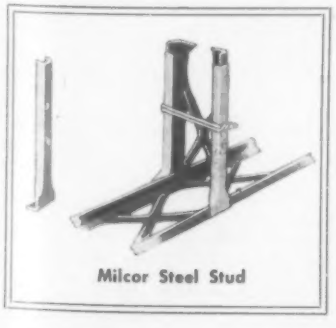
Expansion Casing provides a practical door and window trim. The flush-type junction of wall and casing insures a sanitary finish, with no cracks to become clogged with dirt.

Milcor Expansion Corner Bead is made for outer and inner angles, and its precisely true nose makes a neat, safe, straight line corner. The Expanded Wing, an integral part of the bead, permits the plaster to key through and form a strong bond with the lath beneath, protecting against corner cracks either from blows or strain due to settling.

Write for the Milcor Manual—for complete information on Fireproof Products

MILCOR PARTITION SYSTEMS

These two systems are important contributions to fire-proof construction. The ease with which they can be constructed reduces labor cost considerably and at the same time makes possible partitions of exceptional rigidity and permanence. Certified fire-resistance makes them the partitions for school construction.



Milcor Steel Stud

MILCOR STEEL STUD FOR HOLLOW PARTITIONS

Sound resistance, insulating value, and resistance to shocks and abuse are a few of the outstanding advantages of this system. Write for detailed literature.

MILCOR SOLID PARTITION AND FURRING SYSTEM

Its labor saving simplicity reduces cost and speeds construction. New, improved solid Partition System now being designed for postwar manufacture.

Only three units provide the steel to hold the metal lath in the MILCOR Solid Partition System. These are the Ceiling Angle Runner, the Channel Stud and the Continuous Floor Runner. The Ceiling Runner is attached in position with the Floor Runner directly beneath it. Channel Studs are then slipped into position.

1. Standard Cold or Hot Rolled Channels.
2. Ceiling Angle Runner: Perforated to hold the channel studs in position until wired.
3. Floor Runner: Same as ceiling runner.

SMOOTH CEILINGS SYSTEM

(U. S. Patents Nos. 1,950,422 and 2,000,543)

802 Metropolitan Life Building
Minneapolis 1, Minn.
REPRESENTATIVES IN PRINCIPAL CITIES

A FLAT BEAMLESS UNIVERSAL FLOOR CONSTRUCTION FOR SCHOOL BUILDINGS

Adapted to Reinforced Concrete and Structural Steel Designs by the Modern Method—Elastic Analysis

GENERAL DESCRIPTION—The "Smooth Ceilings" System is normally designed as a 2-way flat slab in accordance with standard building code requirements using the modern method of elastic analysis. The steel column heads or grillages are embedded in the slabs. No concrete caps are required on the columns. The columns may be reinforced concrete, structural steel, steel pipe or cast iron. The floor slabs may be of solid concrete or have light weight blocks or tile fillers embedded in them to reduce dead load and improve plaster bond. Slabs may be built with 2-way joists and removable pans. This system has been used in many important buildings by discriminating architects since 1931. Its practical advantages have been demonstrated in the principal construction centers.

ADAPTABILITY—Because of modern, scientific design methods, the construction is adaptable to irregular column spacing, commonly required in school buildings. It has been successfully used in school and university buildings, with resulting economies in first cost and maintenance.

SERVICES—We license the use of our system by others. We furnish preliminary estimates including quantities of steel and concrete. We suggest suitable framing layouts. We quote delivered prices for steel column heads required. Our engineers are at your service, ready to co-operate. Any qualified structural engineer can design the system.

OUTSTANDING ADVANTAGES AND ECONOMIES

ADEQUATE STRENGTH—Load tests on "Smooth Ceilings" System show very small deflections, good recovery and low stresses in the concrete and steel. **Tested and Approved by Board of Standards and Appeals, New York City and others.**

FLEXIBILITY OF SLAB DESIGN—Floor slabs may be solid concrete or cellular with light weight fillers. Ceilings may be smooth or coffered to suit design requirements. Plaster may be applied directly to the concrete ceiling with or without bond coat, depending on conditions, with resultant cost reduction.

SAVES IN HEIGHT OF BULDING—The full clear height between floor and flat ceiling may be utilized with usually a saving of several inches in each story height, aggregating several feet in the total height of the average building. Not only are construction costs reduced but operating costs are minimized.

FORMING COSTS REDUCED — The flat deck forms require a minimum amount of cutting and fitting. Therefore the cost of forms for concrete is very low and form lumber salvage exceptionally high.

COST OF AIR CONDITIONING INSTALLATIONS REDUCED — Overhead air conditioning duct work is simply and economically installed. The duct work can be run at will on the flat ceilings. No beams, etc., to dodge. Less height is required.

UNPLASTERED CEILINGS — Where smooth forming materials are used solid concrete ceilings may be acceptably finished and decorated without plaster, a further cost reduction.

SMALLER COLUMN FURRING REQUIRED — Due to design of steel column heads small ducts and pipes can pass through slab close to column shaft.

LOW PLASTERING AND DECORATING COSTS—Because of the complete elimination of beams, girders, drop panels and flared column caps, plastering, decorating and finishing costs are materially reduced both in time and material.

IDEAL LIGHTING CONDITIONS—Since there are no interrupting beams, girders, drop panels, etc., the smooth ceiling expanse assures maximum reflectivity, fewer lighting fixtures and less current consumption.

ACOUSTICS IMPROVED—The all flat ceilings are ideal and economical for acoustic treatment.

Wall span 23 ft., corridor span 10 ft.

Morris Park School, Minneapolis, Minnesota
Board of Education, Architect

Note: Tile fillers in slab; irregular column spacing; rectangular columns; inverted wall beams which permit high window heads. $4,200 was saved on this school by changing from one way concrete joists to "Smooth Ceilings" System plus further annual savings in maintenance costs.

TILE-TEX...FLOORS FOR THE MODERN SCHOOL

Willard Hall Dormitory for Women—Northwestern University, Evanston, Ill.

Tile-Tex is an asbestos-asphalt composition tile flooring, which has been used for seventeen years in schools throughout the United States. Tile-Tex floors give uniformly good service, represent on the average a low investment cost per square foot, and are maintained simply and economically. They represent what we honestly believe to be the greatest value in floors for schools that can be purchased today.

Tile-Tex is designed and manufactured to meet the demand for a low cost flooring, installed in tile size units, that will withstand heavy foot traffic under exacting conditions over a long period of years. Prominent school architects throughout the nation specify Tile-Tex consistently and know from experience that the Company manufacturing it can be relied upon to stand behind the material and improve it year after year.

On the following pages are photographs showing Tile-Tex in use in practically every type of area found in schools today. Tile-Tex is often specified because of this versatility and adaptability to a wide variety of uses. Hundreds of Tile-Tex installations in schools throughout the country are mute testimony to the quality of the product and the knowledge and skill of the Tile-Tex contractors who install it.

Tile-Tex is available in three thicknesses—⅛", 3/16", and ¼". It is made in a wide variety of sizes, which include the following: 3x3, 3x6, 4x4, 4½x4½, 4x12, 6x6, 6x12, 6x18, 9x9, 9x18, 9x27, 12x12, 12x24, 18x18, 18x24, and 6" Hexagon.

Tile-Tex welcomes constructive criticism from all school officials and is constantly ready to help in the solution of any problems connected with schoolhouse floors.

The Tile-Tex floor shown above is in the Southampton, L. I., N. Y., Grade School. It is long-wearing, non-distracting to the pupil, easy to keep clean, and suitable for either fixed or movable seating equipment.

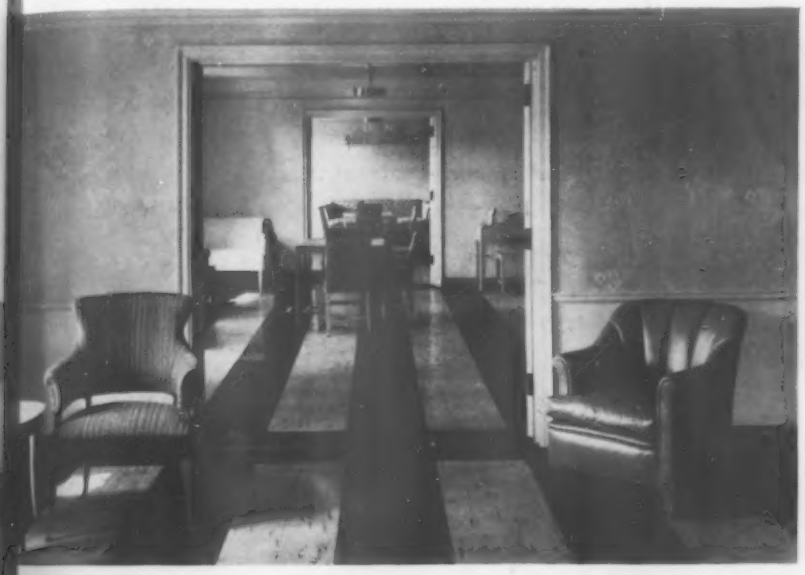
For auditoriums, Tile-Tex is flexible in design, adapted for ramps and inclines, easy to clean, and durable. Below you see Tile-Tex in service in the auditorium of the Bay Shore, L. I., School.

Top photo below—For special areas, such as a domestic science room, Tile-Tex is both practical and attractive. Here ease of cleaning, closely textured surface, and resistance to food abuse are met by the use of Greaseproof Tile-Tex. Installation shown is the domestic science room in the Wappingers Falls, N. Y., Central School.

Bottom photo below—For laboratories, Tile-Tex is acid and alkali resistant, comfortable to stand and walk on, and easy to clean. Tile-Tex was selected for the Guggenheim Dental Clinic laboratory, New York City, because of these qualities.

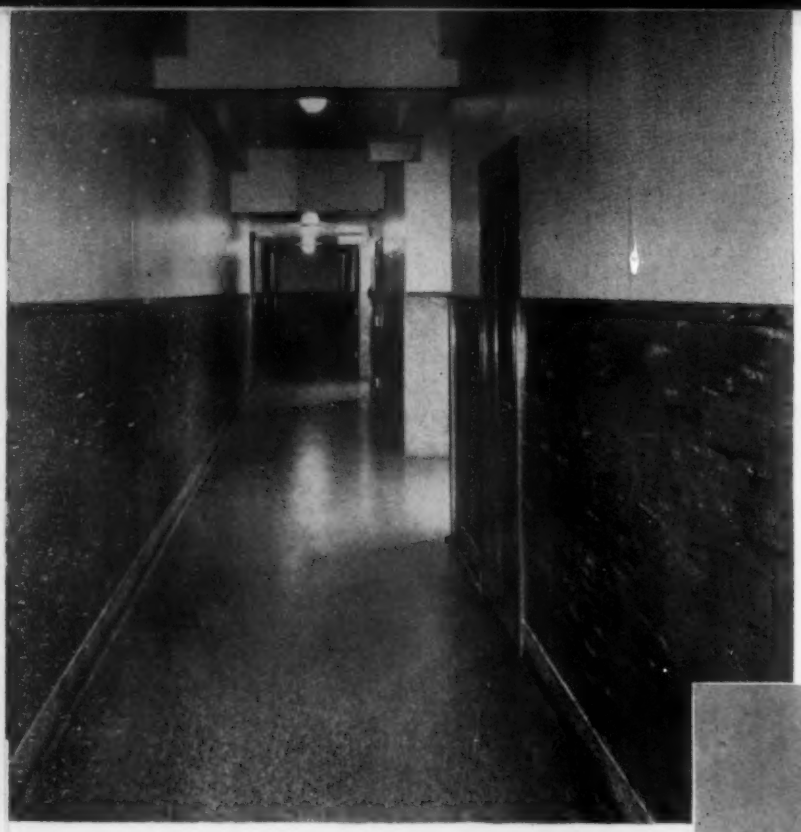
Right—School corridor areas are a "natural" for Tile-Tex floors. The corridor floor shown here, in the Southampton, L. I., Grade School, is safe to walk on, attractive, easy to maintain, quiet, durable, and economical.

Below—For this social room area, in Northwestern University's new Willard Hall, Tile-Tex was found to be the perfect answer for an attractive, serviceable floor, so necessary for this type of use. Note the striking modern design.



Above—Kindergarten, Mattituck, L. I., N. Y., Grade School. Here is a Tile-Tex floor that is safe for children to play on, quiet, attractive, sanitary, and easy to clean.

Right—Tile-Tex was the answer to the floor problem in the gymnasium at St. Vincent's School, Buffalo, New York. Unaffected by moisture, non-slip when unwaxed, and sufficiently resilient, Tile-Tex makes an excellent gymnasium floor.



TILE-TEX WALLS ARE IDEAL FOR SCHOOL WAINSCOTING

Tile-Tex Wall Tile is a new and adaptable wall covering material, well suited for school purposes. It is a flexible, individual tile manufactured from asbestos fibre, mineral coloring pigment, and special binders. Tile-Tex Wall Tile can be applied over existing plaster walls in present buildings, or over smooth plaster backing or smooth-surface wallboard in new construction. Its cost is considerably less than that of conventional ceramic tile.

Above you see Tile-Tex used as an attractive corridor wainscot. Its use here obviates the need of painting over that area covered by the wainscot. Over a period of years, this means a considerable saving as against paint or any other type of surface which must be renewed. Fingerprints, so common on painted walls, will not show up on appropriate, selected colors of Tile-Tex. Any dirt marks or stains can be easily removed with a damp rag and Kitchen Klenzer.

Right—In cafeterias, Tile-Tex has proved itself an excellent wainscot material. In the Wappinger Falls, N. Y., Central School shown here, the wainscot is plain color Tile-Tex Wall Tile. Incidentally, the floor here is also Tile-Tex, laid in colors to harmonize with the wall tiling.

Other areas where this new, unique wall covering can be used are toilets, rest rooms, and laboratories.

Colors—Tile-Tex Wall Tile is available in a wide range of colors, from light pastel shades to medium and darker hues. Over 32 colors are included in the Aristocrat color group. Send for the booklet, "Decorative Walls by Tile-Tex," which includes complete color charts.

Sizes—Fourteen sizes, from small to large, make possible wall treatments heretofore not obtainable with other types of material. Sizes include the following: 3x6, 4x4, 4½x4½, 4x12, 6x6, 6x12, 6x18, 9x9, 9x18, 9x27, 12x12, 12x24, 18x18, and 18x24.

WALLS TILE-TEX FLOORS

THE TILE-TEX COMPANY

CHICAGO HEIGHTS, ILLINOIS
101 PARK AVENUE, NEW YORK

CONGOLEUM-NAIRN INC.

General Office: Kearny, New Jersey

Nairn Linoleum Floors and Walls give extra beauty and service because there is no compromise with quality

IN CLASSROOMS . . . Nairn Linoleum floors and walls help create a pleasant, restful atmosphere. Nairn, the quality linoleum, is unusually wear-resistant . . . gives many years of trouble-free service.

IN CORRIDORS . . . a resilient floor of Nairn Linoleum helps deaden the clatter of hurrying feet. The cove base treatment possible with Nairn Linoleum eliminates dirt-catching crevices.

IN KINDERGARTENS . . . the colorful beauty of Nairn Linoleum makes a gay and cheerful floor. Special decorative, educational insets in a countless variety of designs and colors can be readily created in Nairn Linoleum.

IN CAFETERIAS . . . The smooth, sanitary surface of Nairn Linoleum leaves no hiding place for dust and dirt. Nairn Linoleum needs no costly refinishing even after years of constant service.

IN DOMESTIC SCIENCE ROOMS . . . floors and walls of Nairn Linoleum are water and stain resistant . . . easily kept spotlessly clean. Nairn Wall Linoleum is permanent, will last as long as the building itself.

IN STUDY HALLS . . . the superior beauty and durability, as well as the noise-reducing quality of Nairn Linoleum, make it the first choice for floors and walls.

WHY is Nairn Linoleum "first choice" for floors and walls in schools throughout the country? Because Nairn Linoleum is the quality linoleum. Because Nairn Linoleum floors and walls are beautiful, resilient, and durable. Low in first cost, they are easy and economical to maintain . . . retain their original beauty even under the severest of school traffic conditions.

In schools and institutions of every type, large and small alike, Nairn Linoleum—the most modern of floors and walls—has proven itself to be outstanding for floors and walls of your postwar building.

A handbook on linoleum specifications has been prepared for your use. May we send you a copy?

For modern floors and walls

NAIRN LINOLEUM

easy to maintain
colorful, permanent, resilient

THOS. MOULDING FLOOR MFG. CO.

EXECUTIVE OFFICES

165 West Wacker Drive, Chicago 1, Ill.

DISTRICT SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

THOS. MOULDING

Moultile

Flexible Reinforced MASTER ASPHALT TILE

Moultile Master Asphalt Tile combines all the qualities desirable for school floors. It is highly decorative, quiet underfoot, and has a pleasant resilience and elasticity. Moultile is low in original cost, and exceptionally low in maintenance cost.

Durability is an outstanding characteristic of Moultile Asphalt Tile. Millions of scuffing, scraping feet will cause no perceptible wear . . . will not affect color and texture which are uniform throughout. Moultile, therefore, requires no expensive periodic refinishing.

Moultile is ideal for classrooms, corridors, and lobbies. In gymnasiums it yields a secure footing which does not tire contestants or cause floor burns and may quickly be waxed for dancing.

Reinforced for Extra Strength

Because of its strength Moultile can now be applied, even in the 1/16 inch thickness, over firm, smooth wood subfloors with results heretofore expected only of asphalt tile over cement. It is truly inert and remains permanently bonded to subfloor. Because of its flexibility, Moultile quickly seats itself to the underfloor, permitting immediate use after installation.

Ideal for Basement Floors

Moultile and the asphalt cement in which it is laid are impervious to the alkali and dampness always present in cement resting on the ground, which destroy other types of flooring. Moultile bonds permanently, does not buckle or loosen and will not rot or decompose. It solves the problem of flooring over cement resting on the ground.

Many Colors and Sizes

In spite of war limitations, Moultile is available in fifteen rich colors, plain and marbleized. Thicknesses: 1/8 or 3/16 inch. Sizes: 9 x 9, 12 x 12, and 18 x 24 inches.

PRODUCTS OF THOS. MOULDING . . .
Floors, Walls, Treads, Trim . . . *from Plastics*

FLOORS

Tile
- Moultile
- Greaseproof
- Acid-Resistant
- Non-slip Safety

Troweled-on
- TMB
- Moulstone
- Asphalcrete
- Underlayment

PLASTIC SPECIALTIES
- Moultread Stair Tread and Nosing
- Flexeseling

WALLS and WALL BASES
- Moultile Walls
- Greaseproof Walls
- Acid-Resistant Walls
- Asphalt Cove Base
  - Butt Type
  - On-top Type
- Asphalt Straight Base

MAINTENANCE MATERIALS
- Permagloss Self-polishing Wax
- Sweepolene Sweeping Compound
- Kleenolene Non-caustic Soap

INSTALLATION

Thos. Moulding and other approved flooring contractors contract to install floors anywhere in the United States and nearby countries. Write for samples and complete technical information on Moultile and the Company's other products, listed above.

THOS. MOULDING

Greaseproof TILE

Thos. Moulding Greaseproof Tile resists the grease and oils that discolor and soften other floor coverings. It is ideal for domestic science rooms, kitchens, cafeterias, and machine shops. This flooring has the same resilient buoyancy, the same high strength and other characteristics of Moultile.

THOS. MOULDING

Acid-Resistant TILE

Thos. Moulding Acid-Resistant Tile is a specially formulated Moultile for giving maximum resistance against acidic and alkaline chemicals which are harmful to other types of floor coverings. It is recommended for laboratory installation and for lavatories. It has all the other characteristics of Moultile . . . durability, underfoot comfort, etc.

MAINTENANCE MATERIALS

Good floors deserve good care. The following maintenance materials, specially developed for use on Moultile, are recommended as being safe, efficient and economical for use on all floor coverings.

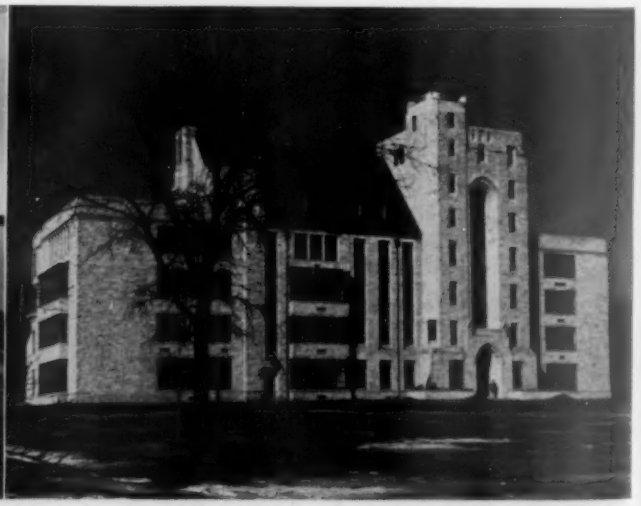
Permagloss—A bright-drying, self-polishing liquid floor wax which contains no oil, grease or other harmful solvents.

Kleenolene—A non-caustic liquid soap which will not injure floors or finishes.

Sweepolene—A sweeping compound made with wax instead of the oil found in commercial compounds.

A Moultile floor in the lobby of the Park St. Elementary School, Marietta, Ga. Note the interesting border effect cutting across the diagonally laid field tile. RICHARD R. NASH, Architect

*Millions of square feet of Moultile have been installed in college and university buildings. **Below: Science Bldg.,** Northern Illinois State Teachers College, DeKalb, Ill. C. HERRICK HAMMOND, State Supervising Architect*



THOS. MOULDING

Wall Tile

A beautiful, enduring wall treatment which requires no periodic refinishing.

Thos. Moulding Wall Tile is a permanent wall finish which may be installed over smooth plaster. The use of Thos. Moulding Wall Tile eliminates, once and for all, the periodic cost of papering, painting, calcimining, etc. Only an occasional washing is needed. Waxing produces a rich, glossy finish. It is strong, durable, non-absorbent, sanitary and fire-resistant.

Thos. Moulding Standard Wall Tile is made from the same type of materials and is fabricated by the same process as Thos. Moulding Moultile. Where special protection is required, however, Thos. Moulding Wall Tile is also available in Acid-Resistant and Greaseproof types.

Thos. Moulding Wall Tile is made in ⅛ in. thickness only. Standard Wall Tile is available in the same range of colors and sizes as Moultile.

THOS. MOULDING

Asphalt Base

FLEXIBLE, EXCEPTIONALLY STRONG

Thos. Moulding Flexible Asphalt Base is an economical sanitary and highly decorative base for use with asphalt tile, linoleum, linoleum tile, rubber, cork, etc. It is exceptionally strong, and being so flexible, conforms readily to wavy walls and is easily bent around corners and pilasters. It is available as Butt Type or On-top Type Cove Base or as Straight Base and can be furnished to match all colors of Moultile.

THOS. MOULDING

Safety Tile

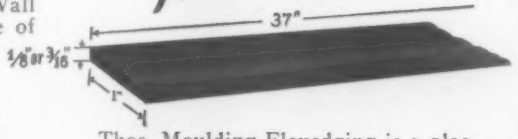
Provides positive, non-slip underfoot safety, even when wet.

Thos. Moulding Safety Tile is a floor tile in which non-slip chips, incorporated during the manufacturing process, give it a surface appearance similar to terrazzo and positively eliminate the slip hazard, even when the floor is wet. Thos. Moulding Standard Safety Tile has all the other characteristics of Moultile and is similarly installed. It is also available in the Acid-Resistant and Greaseproof types.

Thos. Moulding Safety Tile is now widely used in front of elevators, on stair treads, under revolving doors, and in vestibules, stair entrances, ramps, etc., wherever safety is essential.

THOS. MOULDING

Flexedging



Thos. Moulding Flexedging is a plastic molded strip used for abutting floors of asphalt tile, linoleum, etc., at doorways or elsewhere. By turning it upside down, Flexedging can also be used to make a neat juncture between the floor covering and cement coves.

Flexedging is extremely flexible and inert, will lie flat of its own weight without rattling, and quickly conforms to irregularities in the floor. No screwing is required, as Flexedging will adhere with the same cement used for asphalt tile, rubber or linoleum. Standard 37 inch lengths fit across most doorways, and can easily be cut to exact size. Furnished in black only. See diagram above for dimensions.

THOS. MOULDING

Moulstone

COMPOSITION FLOORING

Thos. Moulding Moulstone is a plastic composition troweled on subfloors to form a smooth, seamless, sanitary surface. Because of its great strength, Moulstone is especially valuable for converting old wood floors . . . even those in poor condition . . . into new floors which are safe, attractive, comfortable and easily kept clean. The usual application raises existing floor levels only ½ inch and adds little weight.

Moulstone is low in cost, and ready for use almost immediately. It can be paneled and banded in different color combinations or scored to resemble tile. Moulstone is fireproof, resists oil and grease, and can be made non-slip by sprinkling in non-slip aggregates.

Moulstone has the unusual property of inhibiting development of the fungus which causes athlete's foot. It is therefore recommended for use in locker rooms, toilets and areas surrounding showers. A special water-proof type of Moulstone is available for use within shower stalls.

THOS. MOULDING

Underfloor

TREATMENTS

Virtually any old cement or wood floor, no matter how bad its condition, can be made into a suitable foundation for floor coverings through the application of Thos. Moulding Underfloor Treatments, Underlayment and Asphalcrete. These materials have been specially developed by Thos. Moulding to smooth and strengthen subfloors that are cupped, cracked, uneven or springy.

Thos. Moulding also specializes in the repair of magnesite and mastic floors.

Thos. Moulding Wall Tile, in an attractive buff marbleized color, creates a permanent finish . . . proof against scratching, scuffing or chipping . . . for the walls in this corridor at St. Hedwig's Industrial School, Niles, Ill.

A Moultile floor in the gymnasium of St. Francis de Sales, Minneapolis, Minn. The game lines, inlaid with Moultile in suitably contrasting colors, never fade, never need painting. ELLERBE & Co., Architects

JOHNS-MANVILLE

22 East 40th St., New York 16, N. Y. OFFICES IN ALL LARGE CITIES

J-M SOUND CONTROL FOR SCHOOLS AND UNIVERSITIES

To school authorities faced with a problem involving control of sound, Johns-Manville offers the fruits of long practical experience and a background of more than 30 years of scientific study and research. From the J-M Acoustical Research Laboratories have come many of the developments which have today made it possible to provide a practical, economical solution to any type of sound control problem.

J-M Sound Control consists of three essential services:

NOISE QUIETING—Reducing the noise level in class-rooms, cafeterias, corridors and other locations through the application of J-M Sound Control Materials which "soak up" undesirable noise much as a blotter soaks up ink.

ACOUSTICAL CORRECTION—Eliminating faulty acoustics in school auditoriums, lecture halls, etc.

SOUND ISOLATION—Isolating sounds originating in gymnasiums, manual training rooms, etc., and thus preventing their reaching other areas where quiet is essential. For further details write for a copy of Sound Control Brochure AC-30A.

Right—**A J-M Acoustical Ceiling eliminates disturbing "corridor clamor" at St. Patrick's School, Menasha, Wisc.**

J-M TRANSITE MOVABLE ASBESTOS WALLS

J-M Transite Movable Asbestos Walls were used in this classroom at the University of Wisconsin. Note how adaptable they are for the installation of blackboards

In the construction of school and university buildings after the war the opinion is that more flexibility will be demanded in the building materials used. It is felt that walls and partitions especially should be adaptable to rearrangement and relocation in order that class-rooms may be subdivided or expanded as economy and effectiveness of class-room administration may dictate. Johns-Manville Transite Movable Walls are ideal for this purpose.

They are easily erected and give all the appearance of permanent wall structures; yet they may be just as easily dismantled and relocated with 100% salvage of materials. Made of asbestos and cement they have a smooth, hard surface which may be left in its natural gray finish, or painted and decorated as desired. Furnished in any height—and equally available as railings and counters—they provide a complete system of dry wall construction without the dirt and dampness usually associated with building or remodelling. Long-wearing and easy to maintain, they permit quick, economical expansion or contraction of major areas and the easy rearrangement of individual units. For further details, write for free copy of Transite Walls Brochure TR-41A.

J-M ASPHALT TILE FLOORING

This cafeteria floor illustrates one of many attractive patterns possible with J-M Asphalt Tile. And this versatile flooring is as serviceable as it is beautiful!

Highly wear-resistant, easy to maintain, yet resilient and comfortable to walk on, J-M Asphalt Tile is an excellent flooring for the heavy traffic in school corridors

As a decorative resilient flooring of low first cost, exceptional durability and extremely low maintenance, Johns-Manville Asphalt Tile has found widespread acceptance with school and university officials. Many millions of square feet are in use in classrooms, corridors, gymnasiums and other locations where economy and serviceability are important.

J-M Asphalt Tile is manufactured under standards that are rigidly controlled to insure a uniformly high-quality product. Selected asbestos fibres from Johns-Manville's own asbestos mines are the largest single ingredient. It forms a floor covering that cannot rot, is highly resistant to moisture, resilient, comfortable to walk on, sanitary, and gives many years of service with little attention for maintenance.

J-M Asphalt Tile is available in an extensive selection of plain and marbleized colors and a wide range of sizes, permitting literally hundreds of interesting floor patterns. Made in precision-cut units, the tiles are quickly and economically laid over any suitable sub-floor. All units are pre-waxed at the factory to protect the floor from possible rough usage in connection with other construction activities.

For further information, see Sweet's Architectural catalog or write for full-color Brochure FL-20A.

J-M ASBESTOS BUILT-UP ROOFS

As pioneers in the roofing field and manufacturers of a complete line of built-up roofing products, Johns-Manville recommends the Smooth-Surfaced Asbestos Built-Up Roof as the most satisfactory for school service from the double standpoint of economy and fire-protection.

The asbestos felt as used in the J-M Smooth-Surfaced Roof does not support combustion and therefore provides a marked superiority in fire-resistance over the ordinary roofing felt. The protection offered by the smooth-surfaced asbestos roof against roof-communicated fires has been demonstrated many times in actual service.

Furthermore, since asbestos has the durability of stone, long exposure to sun, rain and weather have little effect on these roofs. Rot-proof, they need no periodic coating with slag or gravel. Maintenance costs are correspondingly low. Many Johns-Manville Smooth-Surfaced Asbestos Roofs that were applied 25 and 30 years ago are still giving service with little or no upkeep, testifying to the outstanding economy of this type of built-up roof.

Further details and specifications furnished on request.

Bonded for 10 years—still going strong after 25 years of service! That's the record of the J-M Asbestos Built-Up Roof on the Poly Prep Country Day School, Brooklyn, N. Y. It is typical of the service provided by these better built-up roofs

THE CELOTEX CORPORATION

Chicago 3, Illinois

AVAILABLE NOW!

We Prepared This Booklet

IN ANSWER TO THE DEMAND FOR INFORMATION . . .

about acoustical correction and noise quieting in schools, colleges and universities.

It will help you analyze your noise problems —in corridors and cafeterias, band practice rooms — auditoriums — swimming pools — classrooms — lecture rooms — laboratories and school offices.

It contains a vast amount of pertinent information including 25 questions and answers about Sound Conditioning schools.

Concisely written and aligned for easy reading. It is yours for the asking — without obligation. Send for your FREE copy now!

Sound Conditioning with

ACOUSTI-CELOTEX

Perforated Fibre Tile SINCE 1923

Sold by Acousti-Celotex Distributors Everywhere In Canada: Dominion Sound Equipments, Ltd.

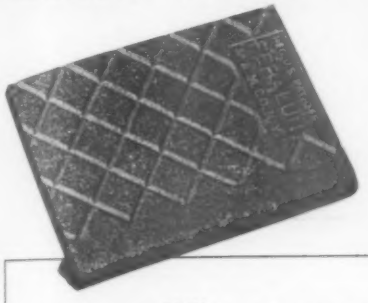
AMERICAN ABRASIVE METALS CO.

IRVINGTON 11, N. J.

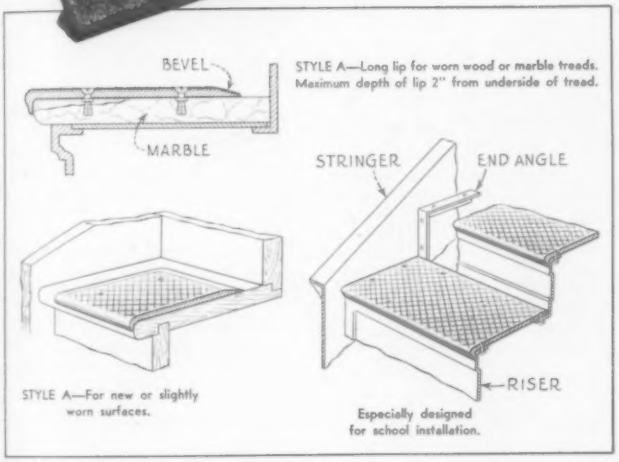
Offices in Principal Cities

ANTI-SLIP PRODUCTS FOR FLOORS, STAIRS, RAMPS AND WALKWAYS

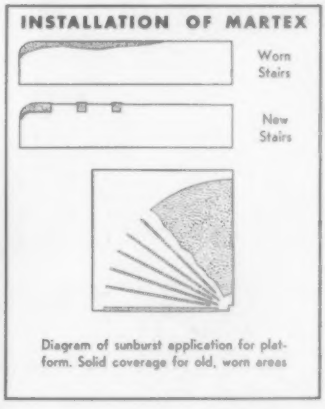
FERALUN ANTI-SLIP TREADS



Feralun is cast metal with abrasive particles of near-diamond hardness imbedded in the surface. Grips wet or dry soles. Feralun Treads require no maintenance and usually last the life of a school. They are made with hatched, plain, or fluted surfaces for stair treads, floor plates and door saddles.


BEVEL
MARBLE
STYLE A—Long lip for worn wood or marble treads. Maximum depth of lip 2" from underside of tread.
STRINGER
END ANGLE
RISER
STYLE A—For new or slightly worn surfaces.
Especially designed for school installation.

NON-SKID MARTEX


INSTALLATION OF MARTEX
Worn Stairs
New Stairs
Diagram of sunburst application for platform. Solid coverage for old, worn areas

Martex is a plastic composition having a high percent abrasive aggregate. On new or only slightly worn stairways it is applied in recessed strips along the nosing and tread surface. It provides complete protection against slipping and checks stair wear. Badly worn treads can be restored to original contour with Martex spread over entire worn area. Martex is extremely durable and bonds perfectly to wood, stone and concrete. Applied only by our own mechanics located in principal cities.

FERROX NON-SLIP COMPOSITION

This synthetic resin floor covering contains non-slip particles that provide secure footing under all conditions. It is applied by trowel, or spray gun to a thickness of only 1/32 of an inch. Developed for the U. S. Navy and widely used on every type of ship. Navy has declared this product ideal. Ferrox is available in colors—Black, Navy Gray, Green, Red and Brown.

FERA-FLOW NON-SLIP FLOOR PAINT

Fera-Flow provides a quick, low-cost method of slip-proofing walkways. This product is a high-grade floor paint containing non-slip particles and is non-slip wet, oily or dry. Fera-Flow will out-wear ordinary painted surfaces and is just as easy to clean. Available in colors: Gray, Green and Red.

WE HAVE THE PRODUCT TO CORRECT YOUR SLIPPING HAZARD . . . WRITE GIVING DETAILS OF YOUR PROBLEM

WOOSTER PRODUCTS, INC.

DEPT. 5ASU

Wooster, Ohio, U. S. A.

- **Wooster Safe-Groove Treads**
- **Wooster Abrasive Cast Treads for stairs, ramps, floor areas and platforms**
- **Wooster Abrasive Cast and Plain Cast Thresholds**
- **Wooster Elevator Sills**
- **Wooster Abrasive Cast Curb Bars**
- **Wooster All Steel Safe-Groove Treads for steel stair construction**

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Free Footsteps from Fear with WOOSTER SAFETY TREADS. Wooster Products, Inc. offers a wide variety of Wooster Safety Treads suitable for all types of educational buildings and stadiums. Out of an experience extending well over 20 years, Wooster Products, Inc. has furnished Wooster Safety Treads, Thresholds, Floor Plates, and Elevator Sills for over 86,000 installations, hundreds of which have been in educational buildings and stadiums. Wooster Engineers have designed a Wooster Safety Tread to meet every requirement of safety, economy and beauty.

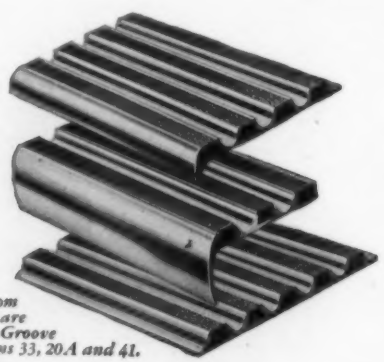
INSTALL WOOSTER SAFETY TREADS ON STAIRS AND RAMPS

. . . for Safety . . . Economy . . . Beauty

Safety—The primary reason for installing any safety tread is safety, and safety should be the first consideration in the design of any walkway. Wooster Safety Treads have been designed to lessen all slipping hazards. Wooster Safety Treads include: Wooster Safe-Groove Treads, either lead or abrasive filled, with steel, brass or aluminum bases; Wooster Abrasive Cast Treads in Ferrogrit (cast iron); Bronzogrit (cast bronze); Alumogrit (cast aluminum) and Nicklogrit (cast nickel).

Appearance—Wooster Safety Treads give assurance that there will be no ugly down-at-the-heel appearance to stairs or other walkways, even after considerable wear. Wooster Treads add materially to the attractiveness of all stairs. Even the beauty of such fine materials as marble, is materially enhanced by the installation of these treads, and they retain their original appearance over a long period of service.

Economy—Safety is priceless. The first cost of Wooster Safety Treads is a mere fraction of a per cent of the total cost of a building. Yet the installation of Wooster Safety Treads may save thousands of dollars by preventing injuries due to falls. The hard, wear-resistant, anti-slip properties of Wooster Safe-Groove Treads and Wooster Abrasive Cast Treads endure with little or no care for many years. Wooster Safety Treads are easily installed, and easily replaced if ever worn out.



Illustrated from top to bottom are Wooster Safe-Groove Treads, sections 33, 20A and 41.

WOOSTER SAFE-GROOVE TREADS

Wooster Safe-Groove Treads, with either lead or abrasive grit fillers, on steel, yellow brass or white alloy bases, are available with integral lip nosings in sections of three, four and five ribs, and in flat sections of three, four, five, six, seven and eight ribs; square and beveled backs. Wooster Safe-Groove Treads provide the utmost protection from slipping; require no maintenance and prevent damage and wear to stair and floor surfaces.

Suggested Applications:

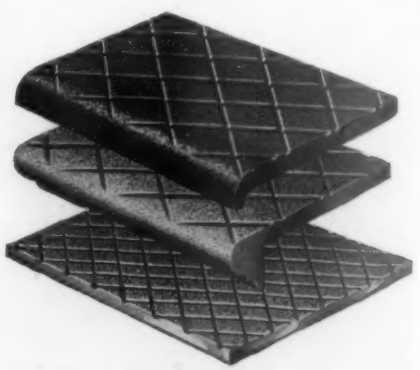
To provide the greatest degree of safety under all conditions, use Wooster Safe-Groove Treads on all stairs, landings, platforms and ramps of wood, concrete, steel or steel sheet pan concrete in dormitories, classroom buildings, libraries, gymnasiums, administration and other educational buildings.

WOOSTER ABRASIVE CAST TREADS

for Stairs, Ramps, Stadiums, Platforms and Floor Areas

There are nine types of Wooster Abrasive Cast Treads. Wooster Abrasive Cast Treads are made in four different cast metals—iron (Ferrogrit), aluminum (Alumogrit), nickel (Nicklogrit) and Bronze (Bronzogrit)—in three different patterns, plain, cross-hatched or fluted. Thicknesses range from ¼ to ⅝ inch, widths from 6 inches to 44 inches, and lengths up to eight feet six inches. Complete range of thicknesses, widths and lengths available only in certain metals. Wooster Abrasive Cast Iron (Ferrogrit) Treads, Floor and Platform Plates are cast from a high grade of iron of pearlitic structure. This grade of metal is not common cast iron, because it is tougher, more resilient, and more corrosive-resistant than the grade of cast iron commonly used. This grade of iron is the result of years of metallurgical research to develop an iron especially suitable for safety tread service, and of broad experience in the use of correct foundry techniques.

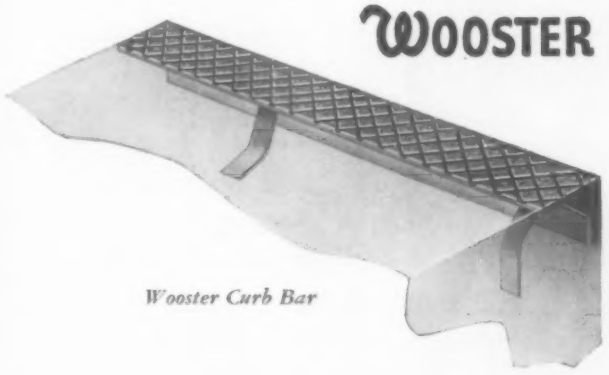
Suggested Applications: Install on stairs, ramps, platforms, stadiums and other floor areas of wood, concrete, steel or steel sheet pan concrete bases.



Illustrated from top to bottom are Wooster Abrasive Cast Treads, Type 101 in cross-hatched pattern, Type 103 in cross-hatched pattern, and Type 100 in cross-hatched pattern.

Repair Stairs, Stadiums and Ramps with WOOSTER SAFETY TREADS

Worn, hollowed-out stair steps, stadium steps and ramps are a safety hazard, and often cause students to sustain painful injuries from slipping and falling. Dangerous walkways and stairs may be easily and economically repaired; their original architectural beauty restored and indefinitely preserved with Wooster Safety Treads. *The proper time to apply Wooster Safety Treads is before stairs and other walkways show the effects of wear. That time is now.* No surface tread ever becomes so worn that it cannot be repaired, with Mastic Cement, to fill up the worn depression, and Wooster Safety Treads. So long as the basic structure is rigid, it is worth repairing with Wooster Safety Treads. Wooster Safe-Groove Treads with steel, yellow brass, and white alloy bases, in the various finishes available, provide a maximum degree of safety. Where service and durability, with maximum safety, are the principal considerations, Wooster Abrasive Cast Treads (Ferrogrit, Alumogrit, Nicklogrit and Bronzogrit) and Wooster Safe-Groove Treads with Steel Base insure safe, sure footing for years and years of use.



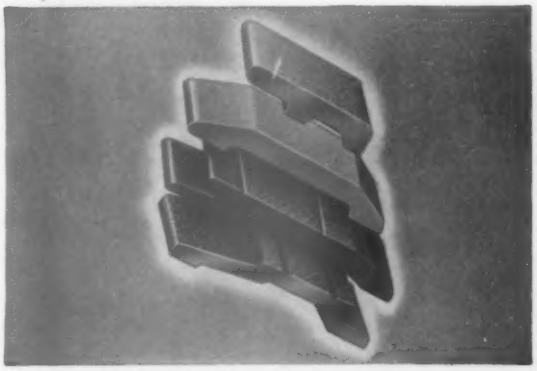
Wooster Curb Bar

WOOSTER ABRASIVE CAST CURB BAR

Wooster Cast Curb Bar is cast from high grade iron of pearlitic structure. It is of higher corrosion-resistance than any of the other ferrous metals and requires no maintenance. Wooster Abrasive Cast Iron Curb Bar provides a new safety feature to eliminate accidents caused by inadequate protection at curbs, terminal platforms, and at various places in stadiums. This product also furnishes a rugged reinforcement for the concrete construction. It has a long-wearing abrasive non-slip surface in which the abrasive grits are cast integrally with the iron to a minimum depth of 1/16 in. This surface is not affected by rain, snow, oil or grease and will maintain its non-slip feature in all kinds of weather.

WOOSTER THRESHOLDS

Wooster Thresholds meet the rigid requirements for substantial as well as economical door thresholds in both plain and weather-stripped types for all types of educational buildings. Their neat trim appearance enhances interior doorways, and they make entranceways safe, distinctive and durable. Wooster Abrasive Cast and Plain Cast Thresholds are molded of plain cast iron, bronze and aluminum; and also of abrasive cast Ferrogrit (iron), Alumogrit (aluminum), Bronzogrit (bronze) and Nicklogrit (nickel). Wooster Rolled and Extruded Metal Thresholds are formed of steel, brass and aluminum.



Wooster Thresholds

CONSULT A WOOSTER REPRESENTATIVE

The Wooster Representative in your locality possesses a background of experience and specialized knowledge of installations in educational buildings that should prove helpful to you. You may get in touch with him by referring to your local telephone or business directory, classifications "Safety Stair Treads" or "Stair Treads." Whenever unable to make proper contact with a Wooster Representative, wire or write factory at Wooster, Ohio.

A COMPLETE CATALOG OF WOOSTER PRODUCTS

Complete information on and illustrations of Wooster Safety Treads and Thresholds are contained in the new Catalog No. 45, which also includes Wooster Elevator Sills, Trench Covers, Platform Plates, Safe Edge Nosings, Curb Bars and Window Sills. Write for file copy today to Wooster Products, Inc., Dept. 5 ASU, Wooster, Ohio, U. S. A.

AMERICAN MASON SAFETY TREAD CO.

Lowell, Mass.

REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA

M A S O N

Abrasive Metal — Ribbed Type
SAFETY TREADS

For Stairways, Stair Landings and Ramps

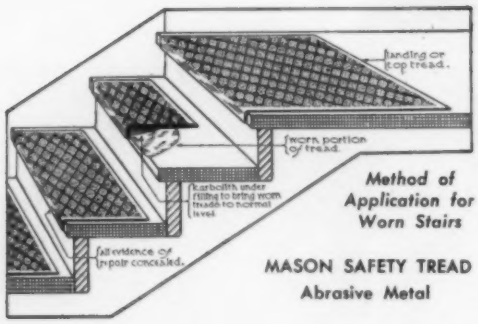
Over Fifty Years of Service to Educational Institutions

POSTWAR plans for extensive school building repairs now being formulated include many stairways, entrances and other heavy-traffic walkway surfaces on which repairs were necessarily neglected during the period of materials restriction.

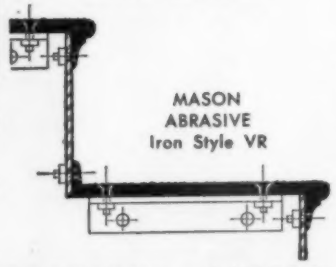
For years **Mason Safety Treads** have filled a very definite need on stairways and other surfaces of slate, wood, concrete or other construction. With Mason Treads, whether you install the Abrasive Metal or the Ribbed Type, your SAFETY problem will be satisfactorily solved. Either type can be quickly and economically installed by your own workmen.

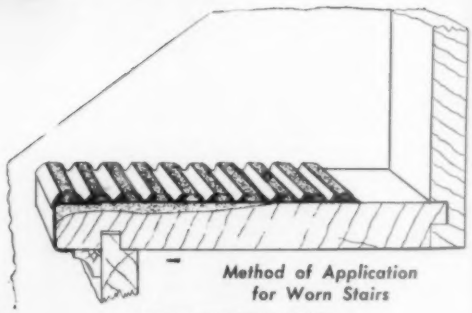
When you specify MASON products, you are assured of receiving *individualized* attention to your particular problem, intelligent engineering service, and a quality product at a fair price.

Write for copy of the MASON catalog—sent free on request to any school official or architect.



Above and Below—
SELF-SUSTAINING TREADS
Used with Steel Risers





SPECIFICATIONS—SAFETY TREADS

New Steel Construction — All stair treads and platforms as shown on plans shall be Mason Abrasive Iron Style VR (or other style as selected) with cross-hatched (plain or fluted if preferred) surface as manufactured by the American Mason Safety Tread Co., Lowell, Mass. Suitable steel supports and stringers with carrier angles shall be provided for securely bolting treads and platforms in place. Sheet steel riser plates (state gauge) shall be bolted to nosings and riser lips of the Safety Tread. Thickness of treads and platforms shall conform to the manufacturer's established standards.

New Concrete or Pan Filled Construction — All stair treads including floor and landing level steps shall be provided with Mason Abrasive Iron Safety Treads Style M (H or G) cross-hatched surface as manufactured by the American Mason Safety Tread Company, Lowell, Mass. (Mason Ribbed Type Steel Base Abrasive Filled Safety Tread, Figure 1A, 2A, 4 or 5 may be substituted.) Safety treads shall be 6 (4, 3½ or 3) inches wide overall and extend from stringer to stringer (for reinforced concrete construction safety treads may extend to within 3 inches of stringers). Standard concrete anchors, spaced according to manufacturer's recommended practice, shall be used to secure safety treads in place.

TYPICAL MASON EDUCATIONAL INSTALLATIONS

HARVARD UNIVERSITY
Cambridge, Mass.
MONTREAL WEST HIGH SCHOOL
Montreal, P. Q.
BROWN UNIVERSITY
Providence, R. I.
PROVINCIAL NORMAL SCHOOL
Fredericton, N. B.
CULVER MILITARY ACADEMY
Culver, Indiana
UNIVERSITY OF MINNESOTA
Minneapolis, Minn.
U. S. MILITARY ACADEMY
West Point, N. Y.
U. S. NAVAL ACADEMY
Annapolis, Md.
UNIVERSITY OF FLORIDA
Gainesville, Fla.
PRINCETON UNIVERSITY
Princeton, N. J.
LOUISIANA STATE UNIVERSITY
Baton Rouge, La.
WILLIAMS COLLEGE
Williamstown, Mass.

AND HUNDREDS OF OTHERS

THE SAFE TREAD CO., INC.

30 Vesey Steet, New York

"SAFE TREAD" ABRASIVE METAL

The responsibility for providing slipproof walkways for the safety of children and teachers has been established by the courts. Maintenance costs, also, are of utmost importance.

When ordering or requesting quotation, please specify kind of metal, type of nosing and surface design, length, width back of nosing, and quantity of each size desired. If unusual shapes are required, furnish detail sketch or template. If for repairs, advise type of material to be covered and any other data that will help us to function.

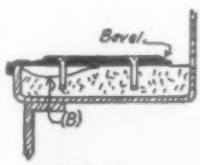
The use of "SAFE TREAD" for new construction or repairs will insure the highest degree of non-slip qualities and the greatest amount of wearability.

FOR NEW CONSTRUCTION

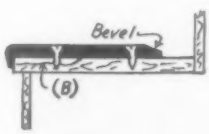
Many other forms are also available for stair treads and nosings, floor plates, trench covers, expansion joints, etc., in "SAFE TREAD" Metal.

FOR REPAIRS

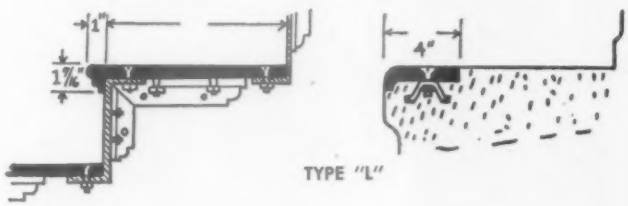
Lip ¼, ½, ¾ or 1" deep to cover worn area, with beveled back and ends, carried to within 2½" of back and 3" of ends of existing treads—worn areas filled with magnesite cement — is recommended practice for repairing worn stair treads.



TYPE "S"
For Steel Stairs



TYPE "XL"
For New Concrete



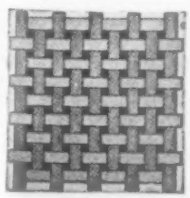
TYPE "L"

"SAFE TREAD" CERAMIC TILE

Being vitrified ceramics with 12% abrasive content, "Safe Tread" Tile are non-porous, fast-colored, and effectively anti-slip, so are particularly desirable for washrooms and locker-rooms in school buildings.

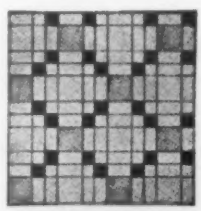
Because of their decorative as well as anti-slip qualities, they are also especially suited for use in entrance hall floors and on all stairways.

Available in all popular colors and sizes.



TWO-COLOR
WICKERWORK
3/4-1 9/16 series
(also 1 1/16-2 3/16)

Submit your walkway problems to us.
We shall be glad to help you solve them

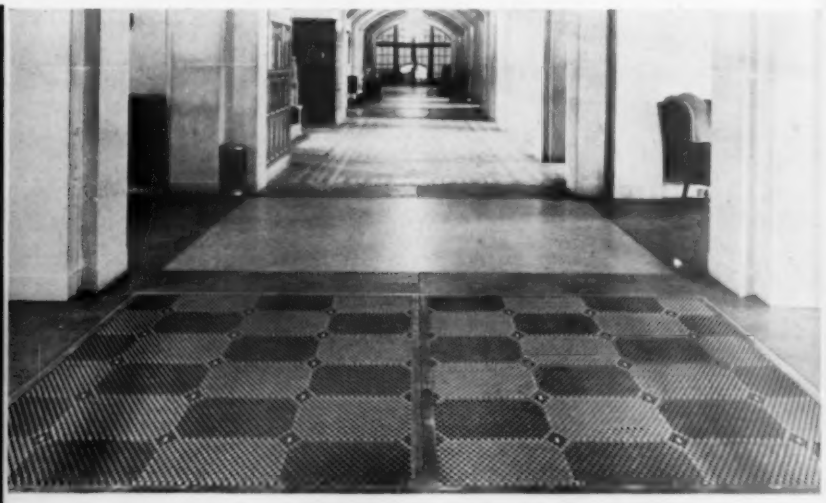


DOUBLE PLAID
3/4-1 9/16 series
(also 1 1/16-2 3/16)

AMERICAN MAT CORPORATION

1700 Adams Street • Toledo 2, Ohio

This is the easy way to SAFETY • SANITATION • COMFORT



America's Largest Matting Specialists

— Now Offering —

AMERITRED SOLID PLASTIC FRICTION MATTING

For entrances, shower rooms, locker rooms, in front of and back of counters in cafeterias, etc. Non-slip surface. Lies flat. Good scrapeage. Easily handled and cleaned. Color: black. Comes in sheets 29" x 62" x 9/64". Can be used side by side or end to end in covering larger areas, or trimmed for smaller or odd-shaped areas. Ameritred is illustrated at left.

AMERIFLEX FLEXIBLE WOOD LINK MATTING

Especially desirable at entrances near parking lots, etc. Lies flat. Follows contour of floor. Beveled edges. Can be rolled or folded for easy handling or cleaning. Ameriflex is illustrated below.

RUBBER MATTING

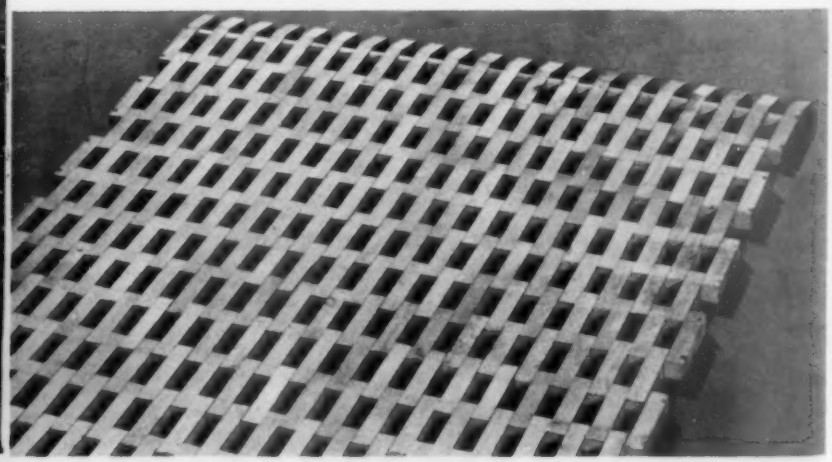
For use in front of exposed switches.

Write for prices and catalog sheets describing various types of matting now available and others which will be offered again after the war, such as Ezy-Rug Colored Rubber Link Matting, as illustrated at top of page.

Describe your floor matting problems to us — we will gladly make recommendations without obligation

EXPERT MATTING REPAIR SERVICE

JOBBERS: Write for proposition

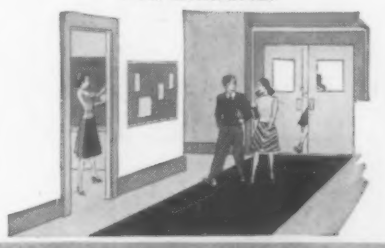


BIRD & SON, INC.

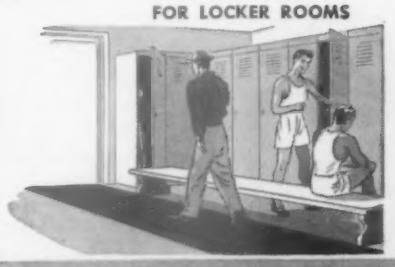
East Walpole, Mass. · New York · Shreveport, La. · Chicago, Ill.

FOR ADMINISTRATION OFFICES

FOR ENTRANCES



FOR LOCKER ROOMS



PROVED . . by hardest Wear in Schools and Colleges

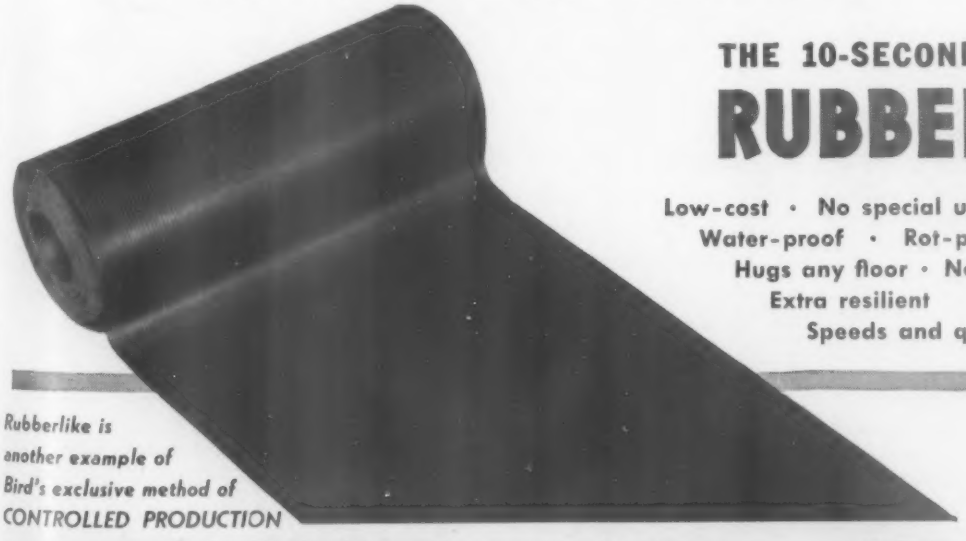
this new floor runner lowers maintenance costs . . . and protects all heavy-traffic floors

MILLIONS OF FOOTSTEPS have passed over Rubberlike, and every report comes back—Rubberlike can take it! Yes—Rubberlike has taken terrific punishment in heavy traffic lanes . . . in factories, hospitals, institutions, office buildings, schools, hotels, apartments, and restaurants.

For this new scientific composition product is waterproof, rot-proof and absolutely slip-proof when wet. It lies flat on any floor, without installation, and can be rolled and re-laid time and again. Easily cleaned, it will not curl or crack with age.

Rubberlike quiets noisy floors, covers worn floors, and makes any floor safer, easier to walk on; low in cost, it lasts for years.

Rubberlike can be purchased without priority; it is available in 36″ width. Call your supply house now . . . or write Bird & Son, inc., East Walpole, Mass., for a free sample.



THE 10-SECOND STORY OF

RUBBERLIKE

Low-cost · No special upkeep · Skid-proof
Water-proof · Rot-proof · Heavy-duty
Hugs any floor · No priority · Long-life
Extra resilient · Preserves floors
Speeds and quiets traffic

Rubberlike is another example of Bird's exclusive method of CONTROLLED PRODUCTION

1795-1945
OUR 150th ANNIVERSARY

ASPHALT SHINGLES · INSULATED SIDINGS
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BIRD

RUBBERLIKE FLOOR RUNNERS · INDEX
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BIRD-FIBRE WOOD FRAME CASES

FREDERIC BLANK & COMPANY, INC.

ESTABLISHED 1913

New York Central Building, 230 Park Avenue, New York 17, N. Y.

• • •

fabron THE FABRIC WALL COVERING FOR SCHOOLS

Color and Texture for Modern School Interiors

Today, making buildings attractive—whatever their function—is a major objective. School managements have recognized the importance of establishing a proper environment as an aid in developing the best approach to life—and have found the introduction of color in interiors a most important step in this direction.

Progressive methods demand the intelligent use of color in accord with the rising standards of informed public taste. Color in schools is correctly used only when it has proper relationship to the entire interior—its size, exposure, correct light reflection, glare reduction, function, etc. In this respect it differs from color in the home where personal tastes usually guide the selection. In schools, however, functional considerations not only determine color but also the **"medium"** of its application, which medium will insure **collective benefits** to the pupils as well as the superintendent in charge of maintenance.

FABRON, the fabric and plastic wall covering manufactured in solid colors and functional textures, represents the **medium** specifically devised to solve these decorative problems. Textures, which present a plain appearance, are produced for walls which receive hard wear—they conceal plaster imperfections, do not show soils readily, require a minimum of upkeep, lend themselves to invisible patching—an ideal combination of features for a wall finish for school interiors, from the angle of the superintendent and pupils alike.

Specialized Advisory Service

Our School Advisory Department with more than 30 years of technical and practical experience in solving school and institutional decorative problems is at your disposal. We co-operate with your architect and your staff in preparing from your blueprints a co-ordinated and complete decorative schedule of color and texture, with samples, quantities, costs, etc., which is submitted with the reasons that motivate the recommendations. Our service is cost free.

What Fabron Is

FABRON is a specially treated fabric devised for the correct architectural finishing of interior walls and ceilings. It incorporates structural, decorative and economical advantages resulting from years of laboratory research plus practical experience in wall covering installations in all types of buildings.

Exclusive Characteristics

FABRON has a sturdy canvas foundation on which layers of plastic coatings have been applied and finished with specially compounded lacquer paints, all fused into a structural unit to withstand hard usage. In one operation, FABRON seals and finishes the plaster surface and gives it decorative value.

Patterns and Color Range

FABRON is produced in a range of solid colors, functional textures and decorative patterns for every type of school interior—Auditoriums, Classrooms, Corridors, Dormitories, Lobbies, Libraries, Offices, and Public Rooms. All are sunfast—washable.

Efficient Roll Size—Easy to Apply

FABRON comes in convenient double rolls measuring 27″ wide by 33¼′ long—a finished surface ready to use. It is hung in the same manner and as easily as any good wallpaper. Any paperhanger of average skill can do the job. It can be installed in a fraction of the time required for painting, without the inconvenience of offensive odors. A room can be occupied the same day it is decorated.

Established Color Scheme Guaranteed

FABRON eliminates all uncertainties connected with hand-applied paint. No mixing or matching of colors, no misunderstandings, no disappointments. Once the color and texture are chosen and FABRON is specified, the job is as good as done and done the way it is specified because the surface is standard in quality, mechanically uniform, and perfect.

Economical in Cost

The cost of FABRON ranges from 3 1/3 cents per square foot up. Elaborate designs cost in proportion. Quality is uniform regardless of price. Its initial cost lies within the average budget for good work and it need not be much higher than good paint which offers no plaster protection. Because it gives years of service and eliminates recurring redecoration costs, its final cost is the most economical of any wall and ceiling treatment.

IN ONE OPERATION FABRON COMPLETES THE SURFACE

Figured on a cost-per-year basis or when considered in relation to capital investment, duration of service, maintenance and repairs FABRON is the most economical wall and ceiling treatment for schools. Its use eliminates the constantly recurring redecoration expense that eats into budgets.

fabron AFFORDS BOTH STRUCTURAL AND PRACTICAL ADVANTAGES

Plaster Protection

FABRON'S sturdy canvas and plastic body gives **permanent** protection to plaster surfaces. . . . It prevents the appearance of unsightly cracks, unavoidable at times in both new and old buildings, which mar wall decorations. . . . In old structures, it binds and strengthens weakened or patched plaster, covers wall blemishes and conceals irregularities.

Readily Removable for Repairs

FABRON eliminates expensive restorations. In case of plaster damages, strips can be lifted, coming "clean" from the wall, the repairs made and the strips reapplied. Damages to FABRON can be patched easily and invisibly by the inset method; any paperhanger of average skill can do this work.

Economy of Upkeep Thoroughly Washable

The washability of FABRON is not superficial but inherent in the product itself. It can be washed simply and easily with water, a soft cloth or sponge and neutral soap, as often as necessary, even by inexperienced help, without affecting its colors.

Sanitary Protection

FABRON can be disinfected with antiseptic solutions commonly used in hospitals for such purposes, without affecting its surface or colors. Waterproof and non-porous, it does not retain soot or dust which are easily washed away. It is vermin proof and odor proof.

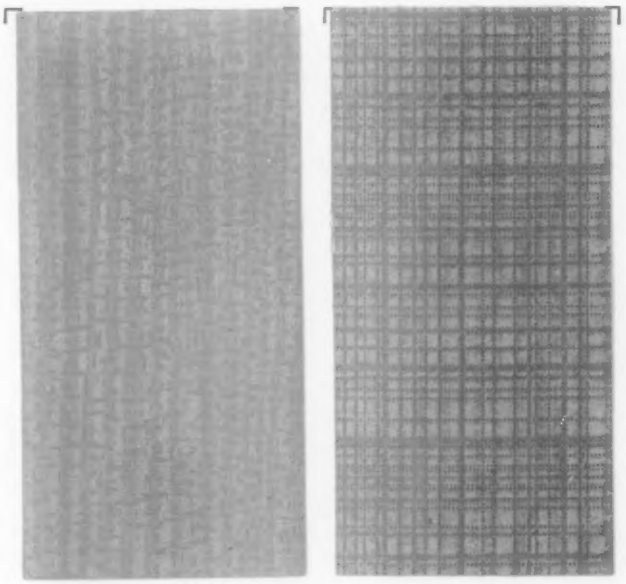
Colors are Sunfast

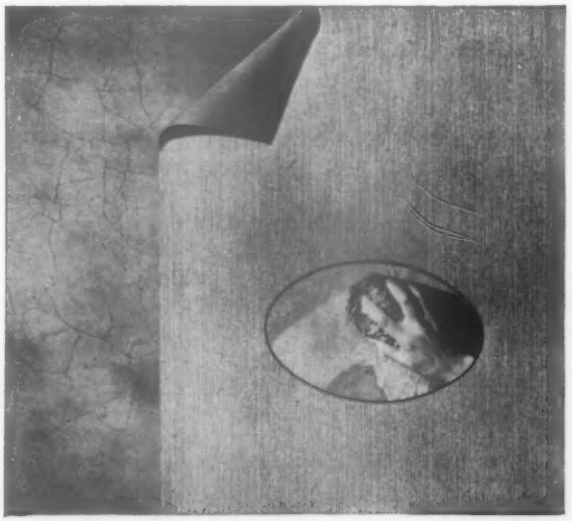
The lacquer paints of FABRON are compounded to resist the action of light. They retain their original beauty and prevent interiors from going stale—this is insurance against depreciation.

Permanent Base for Subsequent Paint or Other Treatments

FABRON'S impervious surface is non-scaling, non-peeling, and resistant to scuffing and scratching. After many years, and when it has outlived its original decorative function, it offers an ideal base for subsequent paint, protecting the walls from cracks indefinitely, thus unlike paint, FABRON **continues** to serve and its initial investment is not irretrievably lost.

STUDY THESE SAMPLES OF FABRON
Experiment with them
FABRON IS NOT AN OILCLOTH





FABRON is easily applied. . . . It prevents the appearance of cracks, strengthens weakened plaster, covers wall blemishes. . . . It is decorative. . . . It is sunfast. . . . It washes clean readily. . . . It is durable and economical

. . . AND IMPARTS DECORATIVE VALUE TO INTERIORS

WOOD CONVERSION COMPANY

Manufacturers of NU-WOOD Interior Finish . . .
and BALSAM-WOOL Sealed Insulation
St. Paul, Minnesota

Balsam-Wool Attic Insulation

It is not only patriotic but practical to insulate the school attic first for fuel savings, and secondly for greater comfort winter and summer. Balsam-Wool, the original Sealed Blanket Insulation, is ideal for schools, as it combines the following qualities which assure lasting efficiency.

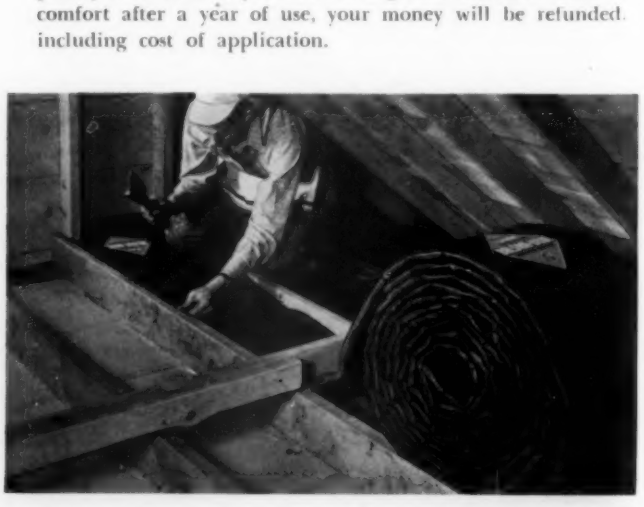
1. **FUEL SAVINGS.** Balsam-Wool is highly efficient—the oldest and best known sealed insulation on the market. Depending on the type of structure in which it is installed, fuel savings as high as 20% may be obtained with it. Balsam-Wool soon pays for itself.

2. **YEAR-ROUND COMFORT.** Balsam-Wool not only helps keep schools warmer in winter, with less fuel consumption, but also prevents heat penetration in summer, keeping rooms cooler during the hot months. It is available in three thicknesses—Standard—Double Thick—and Wall Thick—to suit every insulating need and condition.

3. **PERMANENT.** Balsam-Wool is a lasting insulation because it is designed to meet every condition of use. It is completely *sealed* in an asphalt saturated kraft covering—providing double moisture protection. It has double wind barriers to prevent wind infiltration. It is fire resistant and termite-resistant. Its method of application allows important air spaces, which provide additional insulating value.

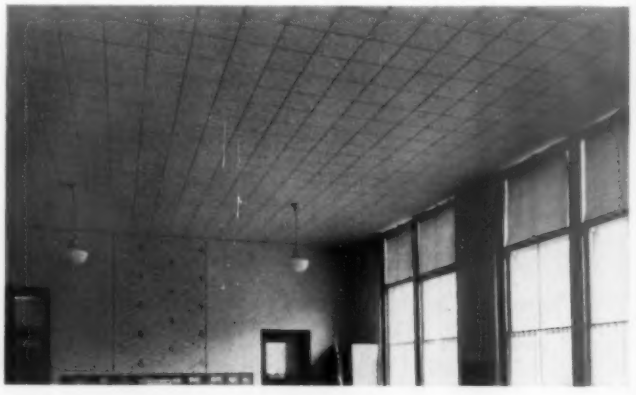
4. **EASY APPLICATION.** Balsam-Wool is quickly and easily applied. The insulating mat is fastened securely to both liners—liners are fastened securely to framing members. Balsam-Wool cannot settle or pack—will not leave uninsulated spaces. Once applied, Balsam-Wool is a lifetime investment in fuel savings and comfort.

5. **MONEY-BACK GUARANTEE.** Balsam-Wool Attic Insulation is sold under a money-back guarantee of complete satisfaction—complete assurance that if you are not completely satisfied with your fuel savings and increased summer comfort after a year of use, your money will be refunded, including cost of application.



Nu-Wood Insulating Interior Finish

Nu-Wood Interior Finish is a wall and ceiling covering for all types of schoolrooms. It is available in many sizes, shapes and colors, making possible unlimited design and color combinations. Nu-Wood builds beautiful pre-decorated interiors, provides additional insulation against heat and cold, improves acoustics and reduces noise. Available in tile, plank, board and wainscot, Nu-Wood units are designed to fit together mechanically and harmoniously, the complete job having the following qualities:



1. **TEXTURE AND COLOR.** A unique textured surface in a variety of fadeproof, harmonious colors which gives walls and ceilings a rich, velvety appearance. A matte surface which reflects light without glare or "Hot Spots."

2. **A NEW, EXCLUSIVE JOINT.** The tongue and groove eliminates breathing—improves insulation value. The shallow bevel reduces the shadow line in keeping with today's interior decoration technique.

3. **INVISIBLE NAILING** made possible by the new Nu-Wood Clip System.

4. **THERMAL INSULATION.** Nu-Wood brings added insulation to the school buildings, helping further to reduce fuel bills in winter and providing greater coolness in summer. Thermal conductivity .324.

5. **NOISE ABSORPTION VALUE.** Nu-Wood absorbs sound, quiets noise, improves hearing.

6. **EASY APPLICATION.** Nu-Wood can be applied directly over cracked plaster or other disfigured walls. Equally adaptable to new or old construction. It requires no maintenance, may be cleaned with a rubber sponge.

7. **LOW COST.** With these advantages—decoration, acoustical treatment and insulation—Nu-Wood is surprisingly low in cost.

KOLOR-TRIM MOLDINGS. The decorative wood molding especially designed to harmonize with the various Nu-Wood shades.

NU-WOOD STA-LITE. A light reflective form of Nu-Wood, with a light reflection of 76%. Sta-Lite has the unusual faculty of actually becoming lighter with use.

FURTHER INFORMATION ABOUT BALSAM WOOL ATTIC INSULATION AND NU-WOOD INSULATING INTERIOR FINISH WILL BE SENT ON REQUEST

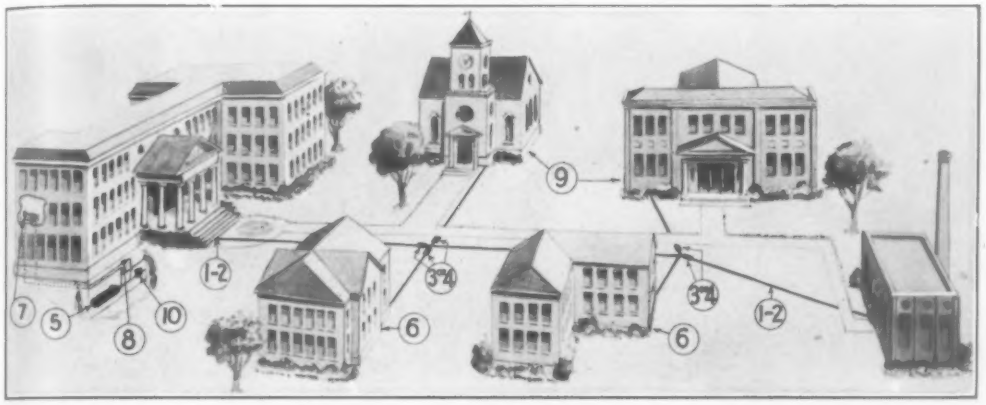
AMERICAN DISTRICT STEAM COMPANY

IN BUSINESS OVER SIXTY YEARS

Manufacturers of District Steam Heating Equipment and ADSCO Water Heaters

North Tonawanda, N. Y.

BRANCHES AND AGENTS IN PRINCIPAL CITIES



1. ADSCO-Bannon Tile Conduit
2. ADSCO Fiberglas Insulation
3. ADSCO Slip Type Expansion Joint
4. ADSCO Packless Expansion Joint
5. Storage Type Water Heater
6. Instantaneous Water Heater
7. Radiator Valves
8. Vertical Steam Trap
9. Reducing Valves
10. Rotary Condensation Meter

DISTRICT OR CENTRAL HEATING FROM A SINGLE BOILER PLANT GIVES HEATING COMFORT, FUEL ECONOMY AND CLEANLINESS

Practically all large universities and many small colleges comprising a group of buildings are heated by a district or central heating system from a single boiler plant through underground lines to various buildings. As each new building is erected, a heating line connects it to the heat distribution system.

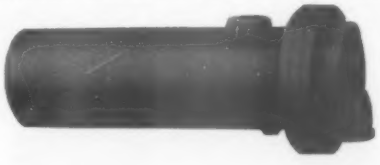
The advantages of a district or central heating system apply to the small as well as to the large college. The boiler plant can be located at a distance from the main buildings and operate with maximum fuel efficiency without the fire hazard, soot, ash and janitorial problems confronting colleges with individual boilers in each building. All basement space can be devoted to college activities instead of partially to boilers, coal bins and ash receptacles.

We manufacture all of the equipment necessary for the complete installation of a district or central heating system and we welcome the opportunity of cooperating with architects, mechanical engineers, college superintendents of buildings and business managers so that we can make recommendations on campus heating distribution systems. A copy of the ADSCO Catalog No. 35 describing our products is available upon request.

ADSCO Storage and Instantaneous Heaters

Plenty of hot water is essential to the modern college and ADSCO can supply storage or instantaneous water heaters designed to meet your exact requirements for domestic hot water in dormitories, laundry and kitchen use, for showers or swimming pool water heating or special water heating or cooling needs.

ADSCO Heaters are simple in design, expertly engineered and fabricated to order in accordance with the latest mechanical standards. Write us of your water heating problem for recommendations and prices on economical ADSCO Heaters or request illustrated Bulletins No. 35-75C and 35-76A.



ADSCO Rotary Condensation Meter

One of these meters in the basement of each college building will tell you the pounds of steam used for heating; enable you to detect heat losses and allocate heating costs. Available in sizes from 250-12,000 lbs. per hour capacity; counter reads directly in pounds, easily installed and cleaned. Write for Bulletin No. 35-80A.

ADSCO Vertical Steam Trap

A compact, dependable float type steam trap with reversible valve and seat, with or without thermostatic air by-pass for vacuum or gravity service. Easily installed to drip steam lines, water heaters, unit heaters or other equipment. Easily maintained—all mechanism mounted on the cover for quick removal without disturbing piping connections. Write for Bulletin No. 35-86.

ADSCO Slip or Packless Expansion Joints

ADSCO offers several types of expansion joints including slip and packless joints for district or central heating systems as well as tile conduit for underground pipe lines, alignment guides, saddle plates, pipe supports, etc., which are illustrated and described in the latest ADSCO Catalog No. 35.

JOHNSON SERVICE COMPANY

Milwaukee 2, Wisconsin

BRANCHES IN ALL PRINCIPAL CITIES

TEMPERATURE CONTROL EQUIPMENT

by JOHNSON

for MODERN SCHOOLS *and College Buildings*

THERE are three general methods of heating and ventilating modern school buildings. In order that all the elements which enter into these systems may be correlated properly and function in correct sequence, it is essential that a complete, unified system of automatic temperature control be installed, as developed by Johnson. No unrelated collection of devices sold "over the counter" and installed by mechanics not familiar with the type of work, will give satisfaction.

1. THE COMBINATION OR "SPLIT" SYSTEM

Heating consists of direct radiators, generally of sufficient size to offset the heat loss from the exposed wall and glass surface. Ventilation requirements are met by indirect radiation of sufficient capacity to warm the air, which is delivered by the duct system.

2. "UNIT" SYSTEM

Direct radiators partially offset the heat loss from the exposed wall and glass surface, and an indirect radiator in the unit ventilating machine furnishes the additional heat necessary and provides for ventilation requirements.

3. BLAST OR "INDIRECT" SYSTEM

A mixture of outdoor and return air is drawn into the combined heating and ventilating system and then forced through automatically controlled heating coils or tempered air by-pass into warm and tempered air chambers. Double Mixing Dampers in the individual duct to each room are controlled by a room thermostat, insuring the proper temperature for each space.

All of the requirements for automatic control of these systems have been carefully worked out by Johnson. Write for booklet with detailed descriptions and illustrations of the three methods of heating and ventilation in modern schools.

THE MERCOID CORPORATION

4207 W. Belmont Avenue Chicago, Illinois

MERCOID

The Only 100% Mercury Switch Equipped Controls

FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

There is scarcely an industry that is not using a Mercoid Control somewhere on vital applications in the control of temperature, pressure, liquid level, mechanical operations, etc. ★ The reason is based on their record for dependable operation and long service. They are easy to install, adjust and require practically no attention ★ The hermetically sealed mercury switches used in all Mercoid Controls are dust, dirt and corrosion-proof, thus assuring positive performance under all operating conditions. These mercury switches are also available to the trade in various types for different applications ★ If you have a switch or control problem, let Mercoid engineers give you the benefit of their wide experience.

Below are a few items briefly described. See catalog No. 600 for the complete line and further information. A copy will be sent upon request.

THERMOSTATS

Various types available for both low and high voltage applications. All types excepting the line voltage type are known as Mercoid Sensatherms, including the regular, Day and Night, Two Stage and dual. All Mercoid thermostats are noted for their close air temperature control.

VISAFLAME CONTROL SYSTEM

(Actuated by Light)

For domestic and industrial oil burners. It operates direct from the light of the flame. Among its many desirable features is the fact that it may be built within the burner unit—a step ahead in oil burner controls.

REMOTE STEM TEMPERATURE CONTROLS

For control of liquids or gases, such as air, oil, water, paraffin, glue or distillate vapors and many other industrial applications. The control is equipped with convenient outside double adjustments.

EXPLOSION-PROOF CONTROL CASES

For use with various Mercoid Controls to be installed in hazardous locations, such as oil refineries, ammunition plants, flour mills, or where dust or vapors form an explosive mixture with air.

DIAPHRAGM CONTROLS

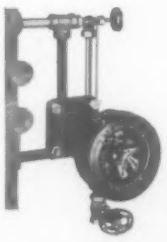
For low pressures where regulation is required in inches of water, either pressure or vacuum. They are used to regulate gas pressures, as safety or signalling devices; also with air circulating fans on recirculating ovens, etc.

LEVER ARM AND FLOAT CONTROLS

These controls have a variety of applications where it is desired to mechanically open and close electric circuits. Mercoid float controls are used for maintaining fluid levels in tanks or for control of sump pumps or cellar drainers. The counterbalanced type is used on tanks where there is a surge in liquid. The plunger type is used on closed tanks.

PRESSURE CONTROLS

For numerous industrial applications. The outside double adjustments eliminate guesswork when setting controls. Indicators show the operating range on the calibrated dial. Available in many pressure ranges for direct or remote connections.



COMBINATION PRESSURE AND LOW WATER CONTROL

For the protection of automatically fired steam boilers to prevent the hazard of firing into dry boilers, also guards against building up excess steam pressure. Equipped with quick hook-up fittings. Various other types of low water controls available.

TRANSFORMER-RELAYS

Type V is a reliable low voltage mercury contact relay which also acts as a transformer inducing low voltage (24 volts) on the pilot circuit. There is no hum or chatter. Used for all types of automatic equipment. Available in various voltages, cycles and circuits.

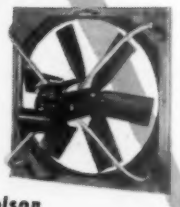
THE HERMAN NELSON CORPORATION

General Offices at Moline, Ill. — Factories at Moline and Chicago, Ill.

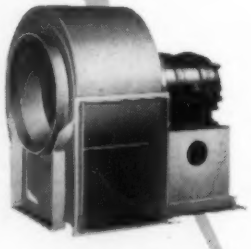
SALES OFFICES AND PRODUCT APPLICATION ENGINEERS IN PRINCIPAL CITIES

Herman Nelson's complete line of Heating and Ventilating Units for schools

Herman Nelson Unit Ventilators



Herman Nelson Propeller Fans



Herman Nelson Unit Blowers

Herman Nelson Propeller-Fan Type Unit Heaters

TODAY, Herman Nelson offers a complete line of heating and ventilating units for all school building projects — whether new or remodeling. Each of these units is backed by the experience, research and pioneering of The Herman Nelson Corporation—for nearly 30 years recognized as the leading manufacturer of heating and ventilating equipment for schools.

So, whether your building plans call for Unit Ventilators for classrooms or auditoriums; propeller fans for kitchen exhaust; blowers for ventilating toilets and laboratories; or unit heaters for locker rooms, it will pay you to investigate Herman Nelson Products. Each unit of the complete line comes in a wide range of sizes and capacities.

Herman Nelson Product Application Engineers, located in principal cities throughout the country, will be pleased to cooperate with you in the selection and application of heating and ventilating units to solve your problems most satisfactorily.

manufacturers of quality heating, ventilating and air conditioning products

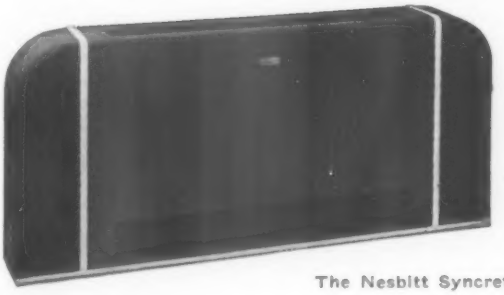
JOHN J. NESBITT, INC.

Manufacturers of

Heating, Ventilating and Air Conditioning Equipment

Holmesburg, Philadelphia 36, Pa.

11 Park Place, New York 7, N. Y.

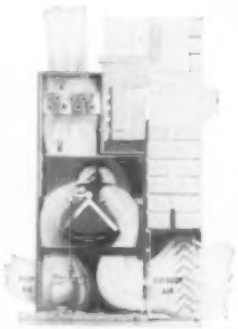


The Nesbitt Syncretizer

Today's Most Healthful Heating and Ventilating for the New or Remodeled School Building

RESULT of years of scientific research and progress, the Nesbitt Syncretizer represents the most advanced thought on heating and ventilating the schoolroom. It brings in and distributes to the classroom a continuous supply of fresh, outdoor air, and "syncretizes" (or harmonizes) it with room air so as to maintain a healthful, comfortable June-like condition, even when the outside temperature is below zero.

DRAFTLESS FRESH AIR WITHOUT OVERHEATING



The Nesbitt Syncretizer prevents drafts, overheating and unpleasant odors. It is adjustable according to any State's laws to deliver all or part outdoor air, but always some outdoor air to occupied classrooms. Its special Air-Stream Minimum Temperature Control provides that all air taken from outdoors is first warmed to a safe minimum temperature, thus preventing drafts. The Room Temperature Control assures that the desired room temperature will be uniformly maintained without permitting overheating.

BEAUTY AND PERFORMANCE

The Syncretizer's simple beauty is conformable to schoolroom needs; it is attractive but not obtrusive. Tests have proved it to be the quietest of units. Its quietness is achieved by the exclusive Nesbitt combination of four silent-type fans, perfectly balanced on a "floating" shaft,, rotated by the quietest motor obtainable, the whole action hushed by an insulated casing. Its economy of fuel and current wins lasting favor. In competitive demonstrations before school boards, the Nesbitt Syncretizer has outsold all other unit ventilators.

MODERN STREAMLINING

Neat, convenient storage shelves integrated with heating and ventilating units can bring a streamlined appearance to a cluttered classroom; they provide adequate storage facilities for the projects and materials that are a necessary part of today's curriculum. Nesbitts now furnish their Syncretizers and auxiliary convectors in special casings when desired for combining pleasingly with standard or specially built storage units. Ask for Publication 244.

Unit Casings to fit with Storage Units modernize the classroom and encourage the habit of neatness.

SERIES B THERMOVENTS

For heating and ventilating auditoriums, gymnasiums, assembly halls and similar gathering places there are the Nesbitt Series B Thermovents. Publication 227-1.

To the men and women of John J. Nesbitt, Inc. has come the highest industrial honor — the Army-Navy "E" Award and two White Stars.

NESBITT *Syncretized Air*

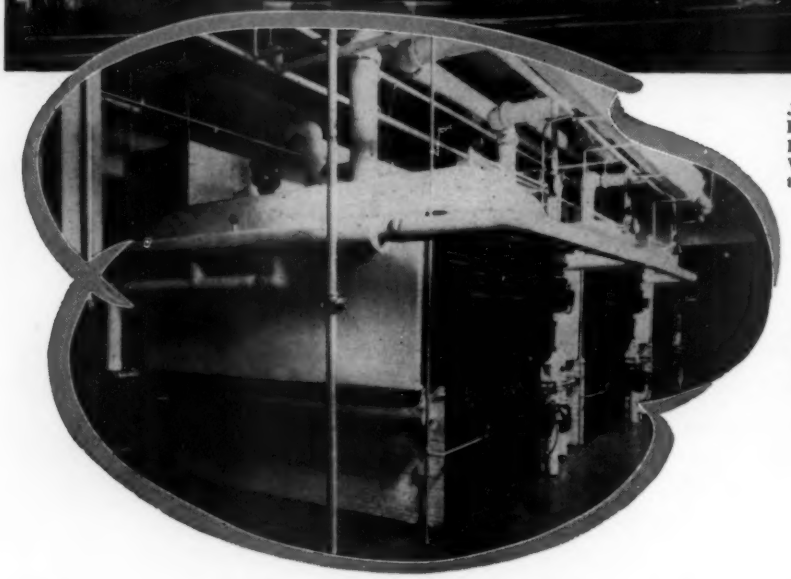
"THE GUARDIAN OF SCHOOLROOM HEALTH"

Nesbitt Syncretizers are sold by American Blower Corporation and John J. Nesbitt, Inc. Complete information is contained in Publication 231. For engineering data, Publication 225-1.

THE H. B. SMITH COMPANY, INC.

Westfield, Mass.

BRANCH OFFICES AND SALES REPRESENTATIVES IN PRINCIPAL CITIES



Junior and Senior High School, Harrison, N. Y. Architect, Robert Vignola, Harrison, N. Y.; Consulting Engineers, Daniel & Wallen, New York City; Heating Contractor, John Winkel Co., Inc., Larchmont, N. Y. Boiler Plant consists of three 20-section 260 Smith Cast Iron Header Type Boilers.

Boiler Plant... for the POST WAR SCHOOL

City school operating officials are obviously in a favorable position to compare fuel and maintenance costs of various types of heating systems. Basing their findings on long term studies of these operating expenses it is significant that more and more school departments regularly specify H. B. SMITH boilers as standard equipment for their buildings.

Architects and Engineers who are now confronted with the specification of heating systems for public schools to be built post war would do well to study installations in like projects erected immediately pre-war to find the answers to many of their questions.

It is our prediction that as far as actual heat generation is concerned, the boiler plant of the 194? school will closely resemble the best installations of 1941. Recently built schools such as Westchester's Harrison High have set the standard for post war school heating.

H. B. SMITH cast-iron boilers installed in hundreds of recently built schools have not only been capable of that flexibility of performance needed by modern heating and air conditioning systems, but have proven themselves adaptable to the use of different fuels and methods of firing forced by the events of the last three years. Despite reductions in the amount of fuel available these SMITH boilers have operated with characteristic economy, reflecting credit on both their specifiers and installers.

It is this proven performance that makes an H. B. SMITH specification the best bet for today's planners of tomorrow's schools.

Complete engineering data and specifications of H. B. SMITH Boilers are filed in the Domestic Engineering Directory and Sweet's "Architectural."

H.B. Smith
CAST-IRON BOILERS

WARREN WEBSTER & COMPANY

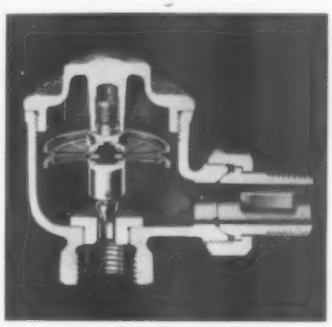
Pioneers of the Vacuum System of Steam Heating . . . Est. 1888

Department A. U.—45 Camden, New Jersey

REPRESENTATIVES IN PRINCIPAL CITIES . . . Consult Telephone Directory

In Canada: Darling Bros., Ltd., Montreal, Quebec

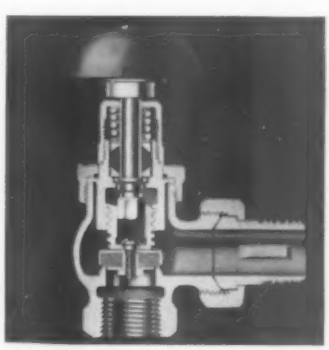
WEBSTER SYSTEMS OF STEAM HEATING, standard in the finest schools and universities, supply heat *when* you want it—*where* you want it. In thousands of schools, from Maine to California, performance records have proved that Webster Systems are highly efficient in any climate requiring heat.



Webster Series "7" Thermostatic Radiator Traps

THE WEBSTER MODERATOR SYSTEM OF STEAM HEATING has just four control elements. (1) An Outdoor Thermostat prevents costly overheating by automatically changing heating rate when outdoor temperature changes. (2) A Variator provides hand control when you want it. (3) A Pressure Control Cabinet assures correct pressure difference in the system. (4) A Motorized Steam Valve admits just the right amount of steam. The steam admitted to the system by these four elements is proportionately distributed to each radiator by Webster Metering Orifices.

WEBSTER SERIES "7" THERMOSTATIC RADIATOR TRAPS hold steam in radiators until it has given up all its heat. Insures against any waste of "live" steam. . . . Available in three sizes—200 sq. ft., 400 sq. ft., and 700 sq. ft. Also in several body models. Employing time-tested Webster thermostatic element, a diaphragm of phosphor bronze fully compensated for pressure.

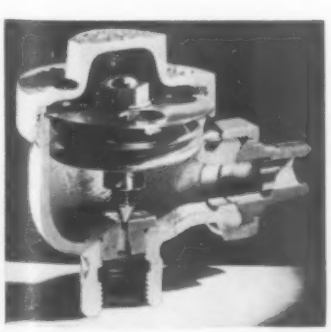


Webster Radiator Supply Valves

WEBSTER RADIATOR SUPPLY VALVES open easily in less than a turn of the handle. Construction is a proven Webster design, fully meeting "spring packless" specifications—a heavy spring pressing on die-molded metallic ring packing. Non-rising stem. Available in five sizes—½", ¾", 1", 1¼" and 1½"—angle body with wheel handle. Also offset and straight-way models in ½", ¾", and 1" sizes.

WEBSTER FLOAT AND THERMOSTATIC TRAPS made for pressure and capacity conditions encountered at all drip points. Continuous draining assured by float-controlled outward opening valve. Full-sized thermostatic bypass insures continuous discharge of all air and non-condensible gases.

WEBSTER DIRT STRAINERS are placed in return lines of the heating system ahead of traps to protect them from pipe scale, dirt and sediment. Basket easily removed for cleaning.



Webster Series "78" Process Steam Traps

WEBSTER SERIES "78" PROCESS STEAM TRAPS insure top-notch results in operation of sterilizers, laundry and kitchen equipment. Built of finest materials, selected for ability to withstand the severe service involved in handling steam at high pressures. . . . Available in five sizes—⅜" No. 780, ½" No. 781, ½" No. 782, ¾" No. 783, and 1" No. 784. Class 2 for pressures of 15 to 60 lbs. Class 3 for pressures of 60 to 150 lbs. Fully compensated for pressure throughout operating range.

WEBSTER PRODUCTS AND SERVICES include: Process Steam Traps, Radiator Valves, Thermostatic Traps, Dirt Pockets, Dirt Strainers, Lift Fittings, Expansion Joints, Steam and Oil Separators, Vacuum Governors, Webster-Nesbitt Unit Heaters, Boiler Protectors, Boiler Return Traps, Vent Traps, Vacuum and Vapor Systems of Steam Heating, Central Heat Controls, Heating Modernization Program.

PETROLEUM HEAT & POWER COMPANY

Main Office and Factory: Stamford, Conn.

Oil Burning Equipment—*"Since 1903"*—Fuel Oils

PETRO
REG. U.S. PAT. OFF

OIL BURNING SYSTEMS

"Cut Steam Costs for Schools and Universities"

Automatic boiler operation is the aim of cost-conscious management, but for various sound reasons, it may not be feasible in certain plants. Consequently, Petro burners are available for three general methods of operation:

AUTOMATIC—SEMI-AUTOMATIC—MANUAL

Petro's operating economies, proved every month in thousands of installations, are due to principles rather than "features" or gadgets. Experience-developed design for specific application, inherent simplicity, and traditionally fine manufacture are basic in Petro burners.

In automatic operation these are enhanced by two important factors in firing efficiency and fuel economy. These are:

(1) PETRO'S THERMAL-VISCOSITY CONTROL

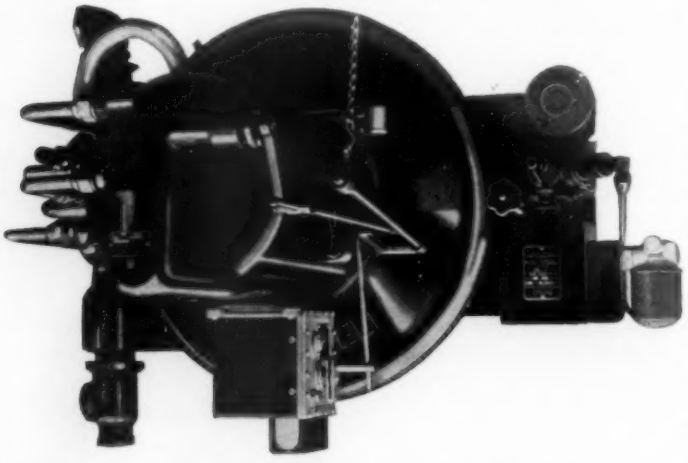
—a well proven system for burning No. 6 or Bunker "C" oil at maximum combustion efficiency under absolute control without any need for frequent manual adjustment—the only method of burning preheated oils which can be called "automatic" legitimately.

(2) MODULATED FUEL CONTROL

—a completely automatic control of high-low operation which permits automatic low fire starting and modulation or acceleration of firing to meet fluctuating steam demands:—maximum combustion efficiency at every stage of firing. Illustration shows modulating motor as mounted on burner (when specified) and arms and linkage through which constant fire-regulation is maintained.

SPECIFYING ENGINEERS will find it helpful to have complete information on these factors which so markedly affect operating costs. Petro Industrial Burner Catalogue may be found in "Sweets," and in "Domestic Engineering" Catalog Files, or copy will be sent gladly on request.

MODEL W-DIRECT DRIVEN, ROTARY CUP TYPE BURNERS



This Burner is a self-contained assembly of motor, fan, pump, rotary cup atomizer and all air and oil adjustment apparatus. Illustrated above is a Petro Model W for Automatic operation on No. 6 (Bunker "C") fuel oil.

Interlocking air and oil control mechanism permits any minimum or maximum operation required within the burner's range of operation. Counter-flow Angular Air Vanes at nozzle increase air and oil turbulence and aid efficient combustion of heavy fuel oils.

Special oil adjustment valve meters oil to rotary cup, yet permits manual operation without disturbing permanent burner adjustment.

CAPACITIES

Model	Motor H.P.	Max. Gals. Per Hour	Rated Capacity Boiler H.P.	Sq. Ft. C. I. Steam Radiation *
W-2½	⅓	11	34	4,800
W-3	½	15	47	6,540
W-4	½	25	78	10,825
W-5	1	33	103	14,300
W-6	2	45	141	19,600
W-7	2	62	195	27,150
W-8	3	100	313	43,500
W-9	3	145	454	68,000

W-2½ to W-9 burns No. 5 fuel oil of 300 seconds maximum viscosity at 100° F. Saybolt Universal or any lighter oils without preheating. When heavier No. 5 or No. 6 (Bunker C) fuel oil is used, preheating is required. Models W-2½, 3 and 4 burners, single phase 110 or 220 volt, 50 or 60 cycle. Model W-5 single phase, 220 volt, 50 or 60 cycle.

All models, 220, 440, 550 volt, polyphase, 50 or 60 cycle.

W-2½ to W-8 belt driven type is available in 25, 30, and 40 cycle A.C. for all standard voltages, single or polyphase; also 115-230 volt D.C.

(*) Equivalent Direct Cast Iron Steam Radiation measured at the boiler outlet.

Removable rotary cup and nozzle permits changing shape of flame to suit requirements of any boiler and prevent flame impingement.

Oil pump is a slow speed, permanently packed, self-priming, self-aligning, non-binding or clogging mechanism, assembled as an integral part of burner. Burners also available without integral pump. Motor is cooled by induced circulation of air. Armature shaft is mounted on two deep-groove annular ball bearings. Splash lubrication from the sump which is below the pump drive, lubricates all bearing surfaces in the burner.

FOR SMALL SCHOOLS — or other structures requiring up to 6300 sq. ft. E.D.R. or equivalent, Petro "Domestic type" automatic burners for light (No. 3) fuel oils are widely used. This line includes conversion burners to oil-fire existing boilers, and complete "Units" for heating and for separate hot water supply. Domestic Catalog on request.

WAR NOTE: *Until war restrictions on materials, facilities and labor are reduced or removed, production of Petro equipment for non-military use must be subordinate to war work and our deliveries of burners are occasionally slower than normal.*

The above data on Petro Industrial Burners is presented for its value in post war planning and is condensed from the complete catalog which will be sent gladly on request.

CANTON STOKER CORPORATION

731 Andrew Place, S. W., Canton, Ohio

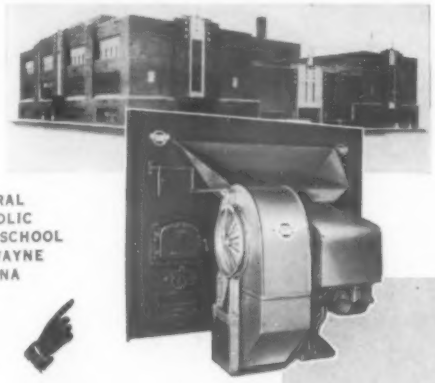
SPECIFIED FOR SERVICE

WHERE DEPENDABILITY AND ECONOMY COME FIRST!

CANTON STOKERS SAVE FUEL, MANPOWER, MONEY

One out of every four CANTON orders received during the past 15 years has been a repeat order.

Canton equipment is operating in 31 states, the District of Columbia and Canada—indicating its adaptabilities to a wide variety of applications and employing its sound and correctly engineered features.



CENTRAL CATHOLIC HIGH SCHOOL FT. WAYNE INDIANA

Two Vulcan Ramfeed Side-Dump Canton Stokers meet every requirement for heat and power economically for the modern Central Catholic High School.

CANTON STOKERS

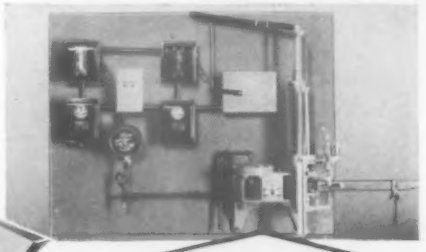
TIMKEN VOCATIONAL HIGH SCHOOL CANTON, OHIO

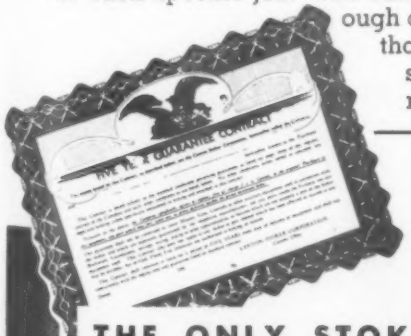
At Timken Vocational, three Lo-Set Ramfeed Side-Dump Canton Stokers are installed under Locomotive Steel Firebox Boilers. Note hopper extensions for overhead loading.

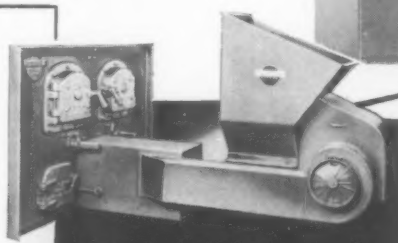
INSTALLATION AT TIMKEN VOCATIONAL

54 TYPES and SIZES for EVERY NEED UP TO 800 H. P.

Rugged construction meets severe service demands. Firing efficiency saves many dollars in fuel and manpower. Canton Stokers are literally engineered for each specific job. You can be certain after thorough analysis of your need, that the Canton model selected will meet all requirements.







SYNCHRONIZED COMBUSTION CONTROL PANEL

Compact, attractive arrangement of Safety Switches, Magnetic Starters, Banking Switch, Pressure Limit Control, Coal Feed Timer and Master Regulator. Positively keeps in balance the Coal feed, the Forced Air and Stack Draft . . . maintains highest efficiencies.

THE ONLY STOKER GUARANTEED FIVE YEARS AGAINST DEFECTS AND WEAR!

CANTON DURAFLEX WORMFEED

A side dump stoker — front fan mounting—zoned air control—especially adaptable to converting existing boilers to stoker firing.

Write today for descriptive LITERATURE AND COST SAVING FACTS

LINK-BELT COMPANY

STOKER DIVISION

2410 West 18th Street, Chicago 8, Illinois

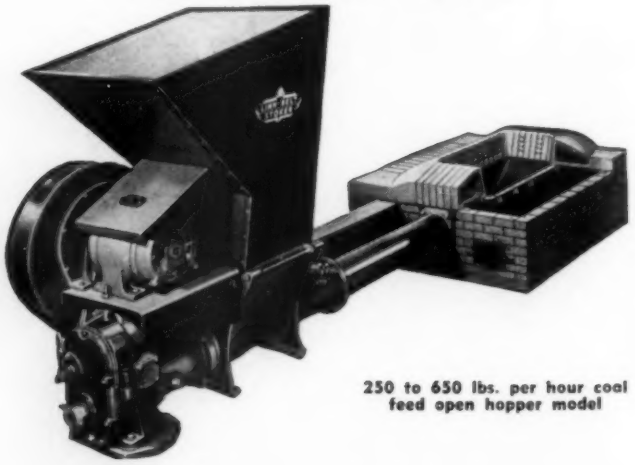
9940

Schools and other institutions over the country are making big savings in fuel costs by installing Link-Belt Automatic Coal Stokers. Not only is the cost repaid by fuel savings, but there are other advantages such as: smokeless operation, automatic pressure or temperature control, attendant freed for other duties, higher capacity, quicker steam generation.

Link-Belt builds a complete line of stokers from bituminous and anthracite domestic units, through commercial sizes, up to bituminous stokers of 1200 lbs. per hour coal feeds.

Link-Belt Automatic Coal Stokers are designed, built and backed by a company with 70 years' experience in engineering and manufacturing.

POWER-FLEX COAL STOKERS



250 to 650 lbs. per hour coal feed open hopper model

150 and 200 lbs. per hour coal feed closed hopper model

1000 and 1200 lbs. per hour coal feed, open hopper model with separate fan

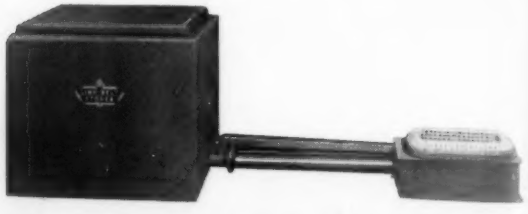
"CHALLENGER" MODEL STOKERS

Bituminous Hopper Model 30 and 50 lbs. per hour coal feed

Bin-Fed Bituminous 30 and 50 lbs. per hour feed

Anthracite Hopper Model 25 to 75 lbs. per hour coal feed

Anthracite Bin-Fed unit 25 to 50 lbs. per hour coal feed with ash removal added

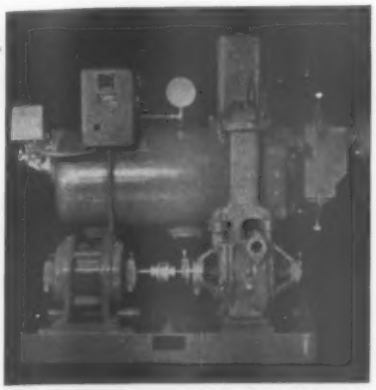


Bituminous Hopper Model 75 and 100 lbs. per hour coal feed shown above

THE NASH ENGINEERING COMPANY

222 Wilson Road — South Norwalk, Conn., U. S. A.

SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES



JENNINGS RETURN LINE VACUUM HEATING PUMPS

Standard with the heating industry for over sixteen years. Jennings Pumps remove air and condensation from the return lines of vacuum steam heating systems, discharging the air to atmosphere and returning the water to the boiler.

Two independent pumping units are combined in a single casing—an air unit which handles only air, and a water unit which handles only water. The capacity of each unit is simultaneous capacity. Each handles the full rated capacity independent of the other. Impellers of both are mounted on the same shaft. The pump is bronze fitted throughout.

Supplied either direct connected to standard electric motors, for belt drive, or for steam turbine drive. For continuous or automatic operation against pressures up to 40 lbs. Supplied standard in capacities up to 300,000 sq. ft. E.D.R. Bulletins on request.

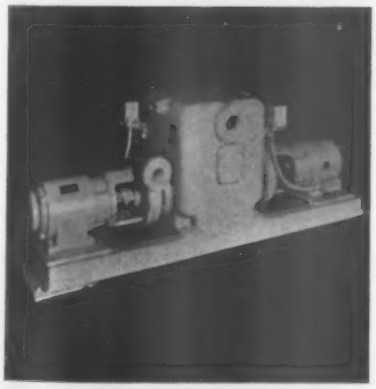
JENNINGS VAPOR TURBINE VACUUM HEATING PUMPS

The Jennings Vapor Turbine Heating Pump combines all of the advantages of the Standard Jennings Return Line Heating Pumps with a new type of drive, a specially designed low pressure turbine which operates directly on steam from the heating mains on any system, requiring a differential of only 5 in. of mercury, and returns that steam to the heating system with practically no heat loss.

This pump affords the economy which goes with a continuous condensation return and steady vacuum, and at no cost for electric current.

The Jennings Vapor Turbine is a safe heating pump, for it functions as long as there is steam in the system, entirely independent of electric current failure. Ideal for Greenhouse, School, and Hospital service.

Furnished standard in capacities up to 150,000 sq. ft. E.D.R. Bulletin on request.



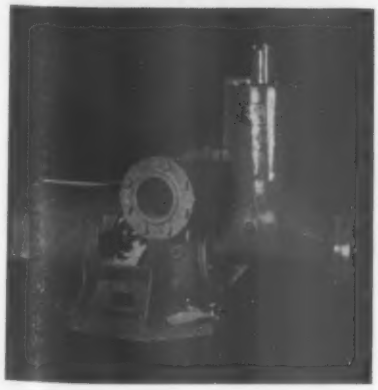
JENNINGS CONDENSATION PUMPS

Jennings Condensation Pumps remove condensation from radiators in return line steam heating systems and pump condensation back to the boiler.

Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Bronze fitted throughout, with Tobin bronze shaft. Impeller is of special design adapted to handling hot water with highest efficiency.

They efficiently remove condensation from radiators, particularly those set below the boiler water line level. Pump casing forms part of return tank, making a compact structure that conserves floor space. Rectangular construction permits installation in corner or against wall.

Jennings Condensation Pumps are furnished in standard sizes with capacities ranging from 1½ to 225 g.p.m. of water, for serving from 1,000 to 150,000 sq. ft. equivalent direct radiation. Bulletin on request.



JENNINGS SUMP AND SEWAGE PUMPS

The Jennings Suction Sump Pump is a self-priming centrifugal pump for handling seepage water and liquids reasonably free from solids. The Suction Sewage Pump is fitted with a non-clog type impeller. Pumps are mounted entirely above the sump where they are always readily accessible. Only the suction pipe is submerged.

There are two moving parts: the centrifugal impeller and the vacuum priming pump rotor. Both rotate without metal-to-metal contact in the casing. Both are mounted on the same shaft that carries the rotor of the electric driving motor, making a compact assembly.

These pumps may be installed away from the pit, or directly over the pit. The Pedestal Type Jennings sets directly on the pit cover, requiring no other foundation.

Capacities and heads to meet all requirements. Bulletins on request.

THE RIC-WIL COMPANY

INSULATED PIPE CONDUIT SYSTEMS

Union Commerce Bldg., Cleveland, Ohio FACTORY: Barberton, Ohio

OFFICES IN PRINCIPAL CITIES

RIC-WIL offers Conduit for every need—

THE MOST COMPLETE LINE—MEETING ALL CONDITIONS OF SERVICE AND COST

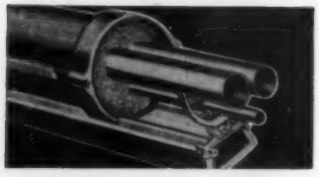
THERE IS A RIC-WIL INSULATED CONDUIT SYSTEM ENGINEERED TO THE SPECIFIC NEEDS OF SCHOOLS, UNIVERSITIES AND OTHER INSTITUTIONS FOR THE DISTRIBUTION OF STEAM AND HOT WATER — PROVIDING THE MOST EFFICIENT INSULATION AND PROTECTION

Ric-wiL INSULATED PIPE UNIT — SINGLE PIPE SYSTEM

Prefabricated complete units—pipe as specified, thoroughly insulated, in helical corrugated conduit, coated with asphalt and wrapped in asphalt saturated asbestos felt. All welded construction—pre-sealed in 21 ft. lengths for speedy installation. Filler-type insulation or sectional pipe covering.

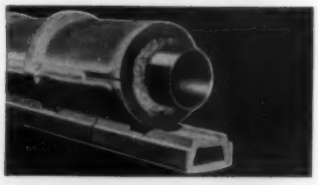
Ric-wiL INSULATED PIPE UNIT — MULTIPLE PIPE SYSTEM

Any specified combination of pipes, insulated and protected same as the single pipe system. Any or all of the pipe lines may be specifically insulated.



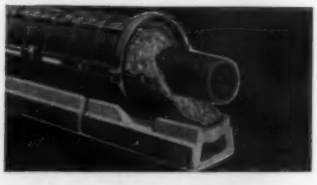
Ric-wiL STANDARD TILE CONDUIT

Vitrified glazed A.S.T.M. Standard Tile housing—acid- and weatherproof—with foundation type base drain supporting weight of piping through correctly engineered pipe support. For single or multiple pipe system—filler type insulation or sectional pipe covering.



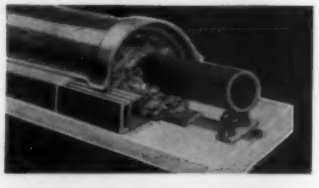
Ric-wiL SUPER-TILE CONDUIT

Same advantages as Standard Tile but with walls approximately double-thick for strength under heavy traffic or where overhead load is above normal. Will support static load of 6 tons per wheel under actual installation conditions. Base drain of extra-heavy tile.



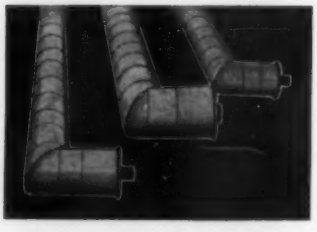
Ric-wiL CAST IRON CONDUIT

Heavy reinforced cast iron conduit for use where underground pipe lines run close to or under railroad tracks. Durable, water tight, vibration-proof, clamps for extra tightness.



Ric-wiL TILE CONDUIT — UNIVERSAL TYPE

Where installation conditions dictate the use of a concrete pad, Ric-wiL Universal Tile is recommended. Side walls are double-cell vitrified trapezoidal block design. Arch may be Standard Tile, Super Tile, or Cast Iron.



Ric-wiL CONDUIT ACCESSORIES

Ric-wiL accessories are available in all type systems: standard and special fittings, factory-fabricated or field-fabricated expansion devices, alignment guides, anchors, etc.

THE GENERAL DETROIT CORPORATION

West Coast Affiliate:
The General Pacific Corp.
Seattle, Los Angeles,
San Francisco

IF IT'S GENERAL IT'S DEPENDABLE

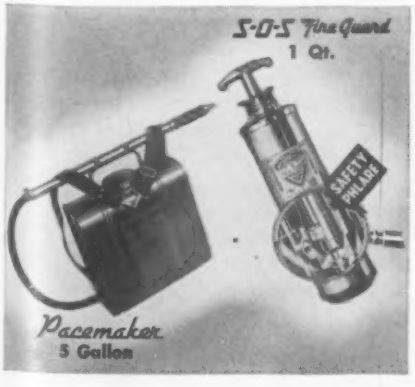
2256 East Jefferson Avenue, Detroit 7, Michigan

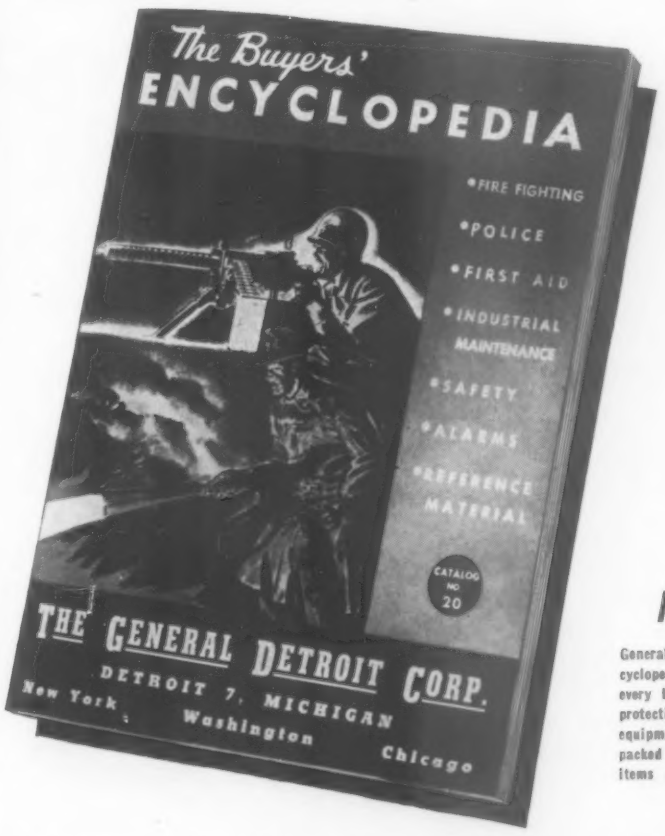
Branches in:
New York, Washington,
Chicago, Dallas
Distributors in all
principal cities

CD/Fog Carbon Dioxide extinguisher. For electrical, chemical, gasoline, paint, and flammable liquid fires. Leaves no stain on clothing or premises. Underwriters' Classification: 15 lb. size, B-1, C-1. Also available in 2, 4, 7½, 10, 20, 50, 75, and 100 lb. sizes.

FLOAFOME 2½-Gallon Foam Type extinguisher. For gasoline, oil, paint, chemical fires. Underwriters' Classification A-1, B-1.

RED STAR 2½-Gallon Soda-Acid extinguisher. For fires in wood, paper, textiles, and rubbish. Sturdy copper construction with exclusive Sure Sweat seams. Underwriters' Classification A-1.





FREE!

General Detroit's Buyers' Encyclopedia is a **must** for every buyer of school safety, protective, and maintenance equipment. Its 48 pages are packed with "hard-to-get" items and important facts.

There are over 500 different items illustrated and described in this big Buyers' Encyclopedia. Everything for fire fighting, safety, first-aid, and maintenance. Many pages of reference material on such subjects as types of fires and how to fight them, types of extinguishers and how to recharge them. Quality-made equipment backed by the reputation of General Detroit, manufacturers of fire fighting equipment since 1905. If you don't have a Buyers' Encyclopedia, write for free copy.

S.O.S. FIRE GUARD Vaporizing Liquid extinguisher. 1 or 1½ quart handy size for any car, bus, truck, boat, home, and airplane. Effective on electrical, gasoline, oil, and chemical fires. Patented Safety Phlare cylinder design insures *new* pump action at all times. Underwriters' Classification B-2, C-2.

PACEMAKER 5-Gallon Knapsack Fire Tank. Water pumped by telescopic action of nozzle-play pipe combination. Underwriters' Classification A-1.

ALASKAN 2½-Gallon and PROTECTOR 5-Gallon Pump Type Extinguishers. Recommended substitutes for soda-acid extinguishers. May be used with anti-freeze charge. Underwriters' Classification A-1.

GRINNELL COMPANY, INC.

EXECUTIVE OFFICES
Providence 1, R. I.
BRANCH OFFICES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

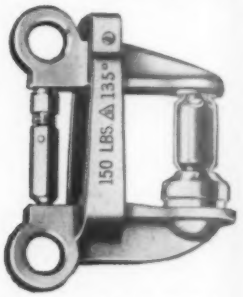
GRINNELL AUTOMATIC SPRINKLER SYSTEMS FOR SCHOOLS AND COLLEGES

*Quartzoid * Bulb Sprinkler*

Sidewall Sprinkler

*DuraSpeed * Sprinkler*

Ornamented Type Sprinkler



*Quartzoid * Bulb Link for Fire Doors*

GRINNELL AUTOMATIC SPRINKLER SYSTEMS

There is a type of Grinnell Automatic Sprinkler System or Fire Protection Equipment to safeguard practically every standard or special hazard risk.

GRINNELL Automatic Sprinkler Systems are installed in all types and sizes of industrial, commercial and institutional buildings. Some properties are protected by either a Grinnell Standard Wet-Pipe System, a Grinnell Standard Dry-Pipe System —or by a combination of both systems, depending upon temperature conditions. Others are safeguarded by the specialized Grinnell Multitrol System.

Thousands of fires have put themselves out in factories, warehouses, skyscrapers, stores, theatres, hotels, piers and docks, hospitals, schools and colleges, churches, institutions, ships—and in many other properties protected by Grinnell Automatic Sprinklers. Such property values exceed fifty billion dollars. And millions of lives are being protected daily by these Sprinklers—ingenious little devices constantly on the alert to quench a fire at its start.

More than 60 years of installation experience in various types and sizes of buildings have given Grinnell Engineers a background and training to cope with any fire protection problem encountered in any property under consideration. During this time, Grinnell Automatic Sprinklers have extinguished, with trivial losses, thousands and thousands of fires which otherwise would have developed into serious losses in life and property.

SCHOOL FIRE LOSSES HEAVY

Despite the fact that modern construction, fire-resistive building materials, proper exits, fire drills, etc., are being used to combat it, fire is daily exacting a heavy toll in schools and colleges. So-called "fireproof" buildings can serve as stoves in which contents can burn.

Authentic records show that during 1944 alone, fires caused a property loss of over $4,758,500.00 in such buildings. As for the loss of life, no money value can ever measure the sorrow in any family where a child was burned to death or seriously crippled.

SPRINKLERS ASSURE PROTECTION

The surest way to prevent fires in school and college properties is to install a Grinnell Automatic Sprinkler System. On silent duty day and night, year in and year out, it will stand guard, ready to quench a fire at its start. Statistics show that automatic sprinklers are proving 93% efficient in banishing the danger of fires in all types of school buildings.

REDUCED INSURANCE RATES

In addition to assuring adequate protection to life and property, the installation of a Grinnell Automatic Sprinkler System generally results in insurance rate reductions ranging from 50 to 90%. Such savings can be applied toward payment of the system and, after payment is complete, they prove an excellent return on the investment throughout the life of the building.

ESTIMATES WITHOUT OBLIGATION

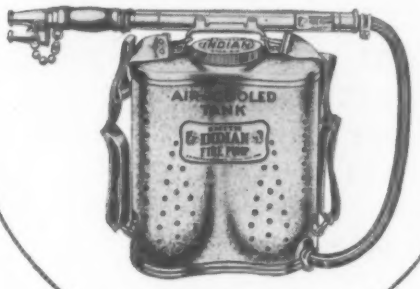
Hundreds of schools and colleges are enjoying the many benefits a system of Grinnell Automatic Sprinklers assure. Surveys and estimates for any particular building will be gladly furnished without cost or obligation. A request to any of our offices in principal cities or to Grinnell Company, Inc., 277 West Exchange Street, Providence 1, R. I., will receive prompt attention.

* Reg. U. S. Pat. Off.

D. B. SMITH & COMPANY

Manufacturers of Indian Fire Pumps

Utica, New York



The *INDIAN FIRE PUMP* is strongly built of best materials and will give years of service. Many schools and other institutions have them as regular equipment. The 5 gal. tank carries slung high on the back like the Army pack. Does not flop against hips causing fatigue.

Order several *INDIAN FIRE PUMPS* now and give them a trial. You will be amazed at the low price of these *"one man fire departments."* Entire outfit is built for hard usage. Tank has double locked seamed bottom — sweat soldered.

INDIAN *Fire* PUMPS

are the best answer to your Fire Problem

Pupils may be taught quickly how to use an *INDIAN FIRE PUMP*

THE school or college which has an ample supply of *INDIAN FIRE PUMPS* has adopted the best fire insurance policy. These famous clear water extinguishers are quickly thrown on the back like a pack basket by the students, teachers, or anyone for fighting fires. They are easily carried and permit freedom of movement.

Rust-proof tank holds 5 gals. of water —no chemicals needed—and may be filled at any water supply. Easy pumping throws pressure stream 30 to 50 ft. or nozzle adjusts for spray. *INDIAN FIRE PUMPS* are equally as effective on inside as on outside fires.

Thousands of *INDIAN FIRE PUMPS* are in use by fire departments, foresters, institutions, Army and Navy, industrial plants and many others.

Send for catalog which gives full details and prices

Fires in corridors, rooms, stores, etc., can be brought under control fast with *INDIAN FIRE PUMPS*

An *INDIAN FIRE PUMP* is ideal for controlling fires on campus and grounds

The ease of operation makes it simple for girl students or women teachers to use *INDIANS* if the need arises

D. B. SMITH & CO. ● 423 Main Street ● UTICA 2, N. Y.

Pacific Coast Branch: Hercules Equipment & Rubber Co., 435 Brannan St., San Francisco, Calif.

Roy G. Davis Co. 617 E. Third St., Los Angeles 13, Calif.
Carco-Conwhit Co. 520 S.W. Pine St., Portland 4, Oregon
The Conwhit Co. Klamath Falls, Oregon
Mill & Mine Supply Co. 2700 4th Ave. South, Seattle, Wash.

STREAMLINE PIPE AND FITTINGS DIVISION

MUELLER BRASS CO.

Port Huron, Michigan

PROTECT THE INVESTMENT FOR THE LIFE OF THE BUILDING BY INSTALLING *STREAMLINE* COPPER PIPE FOR THE PLUMBING AND HEATING SYSTEMS

STREAMLINE bronze solder fittings and copper pipe are a radical departure in conducting systems for plumbing, heating or industrial use. Their unique method of connection has made it possible to use copper piping of hard temper and of a sufficient wall thickness to meet all requirements of actual service. This is in direct contrast to threaded copper pipe, which had to carry a very heavy wall to insure a sufficient thickness to meet service conditions after this thickness had been cut away approximately 50% in the fabrication of the thread. Threaded copper pipe for this reason is naturally very expensive and gives no extra service for its additional wall thickness on the unthreaded portion.

STREAMLINE Solder Fittings are manufactured under U. S. Patents 1,770,852; 1,776,502; and 1,890,998

Illustrating Mechanical Features of the STREAMLINE Fitting

STREAMLINE solder fittings and copper pipe are installed at a price very slightly in advance of rustable materials.

STREAMLINE fittings and copper pipe are ideal for use in all types of educational buildings for all general plumbing and heating purposes: for steam supply, condensate return, cold water, drinking water supply and return, and hot water supply and return piping. Among the many advantages are:

High resistance to corrosion and clogging—Under normal conditions of soil and water, copper does not corrode or rust as iron or steel does. The absence of anchor points due to the continuously smooth waterway through pipe and fitting tends greatly to eliminate clogging.

Light Weight, yet great strength—The STREAMLINE solder fitting, less heavy and consequently less expensive for any given size, produces a connection that is enormously strong and leakproof.

Minimum space required—Although STREAMLINE solder fittings produce enormously strong joints, they are very little larger than the pipe lines which they connect. They do not protrude like screw type fittings. Since these fittings are not screwed into place when connected to the pipe and no space is required for wrench handling, etc., they can be installed very close to each other, thus saving considerable space.

Leaks due to vibration eliminated—Constant vibration has no effect on a joint made with STREAMLINE solder fittings. Its effects are not localized as is the case with screw type fittings, but are harmlessly dissipated throughout the system.

Visual proof an exclusive feature of the STREAMLINE Fitting.—When the mechanic installs STREAMLINE he can tell at a glance that the joint he has made is permanently leakproof without an actual pressure test. This is a valuable asset especially in concealed work.

The STREAMLINE solder fitting is not connected by threading or flaring but by soldering, utilizing one of nature's laws—capillary attraction—to form a permanently tight joint of great strength. The joint, in contrast to threaded connections, is actually reinforced and is the strongest point in the line, instead of the weakest.

Cut-away Sectional View of STREAMLINE Tee. Note How Pipe Is Recessed Into the Fitting, Resulting in a Uniform Smooth Waterway

The illustration herewith shows the mechanical features of the STREAMLINE solder fitting. After the joint has been fluxed and assembled in the pipe, it is heated and solder introduced through the feed hole. Capillarity immediately distributes it thoroughly and evenly between the bonding surfaces, producing a joint so strong that in a pulling test, the pipe will actually break while the joint remains without the slightest damage. It requires over 9000 pounds of pull even before the fracture in the pipe occurs. This, of course, is away beyond anything required of it in actual service.

ESPECIALLY RECOMMENDED FOR HEATING PLANTS

STREAMLINE hard copper pipe and fittings are particularly recommended for all heating plants—whether by hot water or steam—a special virtue of copper pipe being its capacity to hold heat with a minimum of radiation, yet to conduct it very rapidly, so that there is a minimum loss of heat when being conveyed from the point of generation to the points of distribution. Since copper cannot rust, the original delivering capacity of STREAMLINE pipe remains the same indefinitely. In all heating plants, we claim greatly increased benefits in all installations made with STREAMLINE, with noteworthy savings in both fuel and material.

Coupling

STREAMLINE pipe and fittings are installed in over four hundred schools and colleges throughout the United States and, in fact, in every type of building construction. They have been specified by leading architects everywhere.

Tee

STREAMLINE fittings are furnished in complete range from ¼" to 10".

Elbow

COPPER FOR VICTORY

In war, as in peace, copper has advantages that are duplicated by no other metal. Its special properties have made it indispensable for many uses . . . in munitions, ships, trucks, tractors, planes, and other essentials. In the present emergency, every pound available is needed by your Government and the industries manufacturing for war use.

When peace comes and copper has done its part to bring victory, it will again become available for water works and allied uses. It will provide again the longest lived, most economical piping that can be produced.

The word STREAMLINE is the Registered Trade Mark of the Mueller Brass Co., Port Huron, Michigan

Cross

Write for Catalog.

87 YEARS OF SERVICE

MUELLER CO.

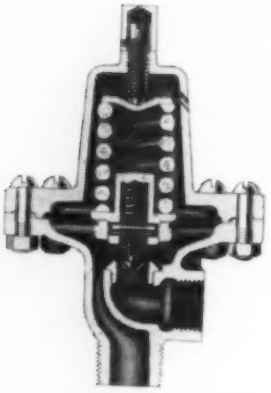
FOUNDED 1857

Decatur, Illinois

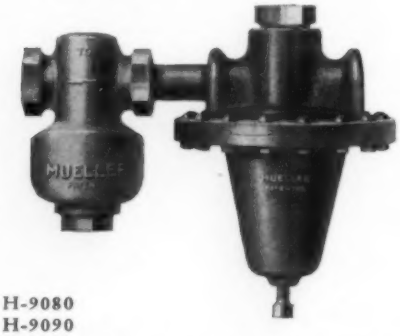
CHATTANOOGA, TENN. ★ LOS ANGELES, CALIF. ★ SARNIA, ONT., CANADA

MUELLER REGULATORS AND RELIEF VALVES

All MUELLER Relief Valves have the EXCLUSIVE AUXILIARY SPRING SEATING PRINCIPLE which prevents imbedded seat discs and insures instant relief within 5% of the pressure setting. Used to protect domestic hot water tanks, heating systems, etc. MUELLER Regulators have larger diaphragms to insure sensitive regulation and maintain steady outlet pressure even though the inlet pressure fluctuates considerably. All are well made of high grade materials by skilled craftsmen.

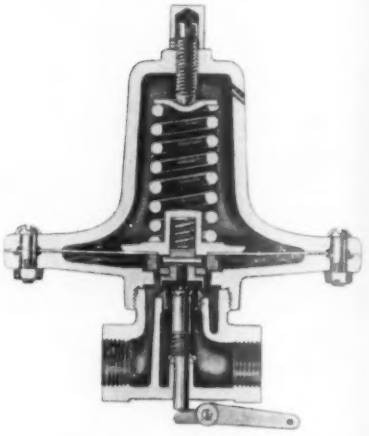


H-9045 Pressure relief valve without testing lever. Particularly adapted to hot or cold water, air or oil. Furnished for any pressure between 5 and 160 lbs. Made in ½″ size only, with ¾″ outside thread inlet; ½″ inside thread outlet

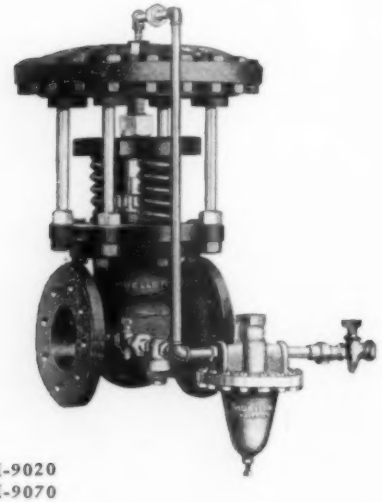


H-9080
H-9090

The H-9080 steam regulator and the H-9090 air or oil regulator are the direct operated type, and are recommended for large reduction requiring limited volume. Variation in inlet pressure does not affect outlet pressure. Furnished in sizes ¼″ to 2″ inclusive



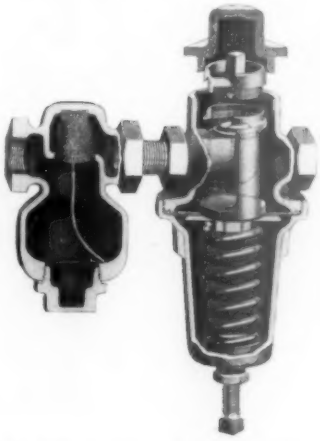
The H-9052 is a larger diaphragm operated relief valve with testing lever, covering a wide range of capacity. This valve conforms to the A.S.M.E. Code and meets the requirements for large boiler installations. Furnished set for any pressure between 5 and 160 lbs., in sizes ½″, ¾″, 1″, 1¼″, 1½″ and 2″



H-9020
H-9070

The H-9020 auxiliary operated regulator for water or air service can supply full pipe line volume at accurately controlled delivery pressures. Has large seat opening and bronze working parts. The H-9070 is of similar construction but designed for steam service. Both are easily adjusted, and are well adapted to industrial service. Sizes 1″ to 12″ inclusive

H-9030 The MUELLER Strainer is an inexpensive and reliable device which can be depended upon to stop foreign substances detrimental to every faucet and valve on the line. It soon pays for itself through a saving in repairs and maintenance. Regularly furnished with iron body; all bronze will be supplied upon order. Sizes ⅛″, ¼″, ⅜″, ½″, ¾″, 1″, 1¼″, 1½″, 2″, 2½″, 3″ and 4″



H-9000 This Pressure Reducing and Regulating Valve and Strainer is recommended where the pressure exceeds 45 lbs. Especially adapted for residence, apartment building and industrial service. Regulator is all bronze with iron body strainer. Bronze strainer will be furnished upon special order. Furnished for initial pressures from 45 to 250 lbs., with delivery from 25 to 75 lbs. Sizes ¼″, ⅜″, ½″, ¾″, 1″, 1¼″, 1½″, 2″ and 2½″

87 YEARS OF SERVICE

MUELLER CO.

Decatur, Illinois

CHATTANOOGA, TENN. ★ LOS ANGELES, CALIF. ★ SARNIA, ONT., CANADA

FOUNDED 1857

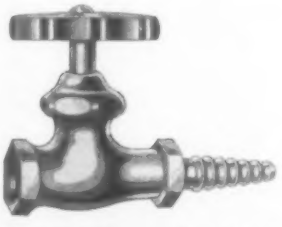
H-12060 Pedestal Laboratory Fitting. Pedestal inlet ⅜" or ½" inside I.P. thread. Outlets at right angle. Flat lever handles. Tapered corrugations for hose

H-12050 Pedestal Laboratory Stop. Pedestal inlet ⅜" or ½" inside I.P. Thread. Tapered corrugations for hose connections. Also furnished as one stop, three stop and four stop fittings

H-12015 Ground Key Laboratory Stop with tapered corrugation for hose. Flat lever handle. Inside I.P. Thread

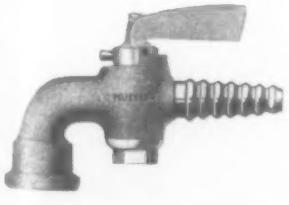
H-12017 Ground Key Laboratory Stop with tapered corrugation for hose. Flat lever handle. Outside I.P. Thread

Furnished with indexed handles upon request



H-12020 Compression Laboratory Stop. Wheel handle and detachable hose nipple. Inside I.P. Thread

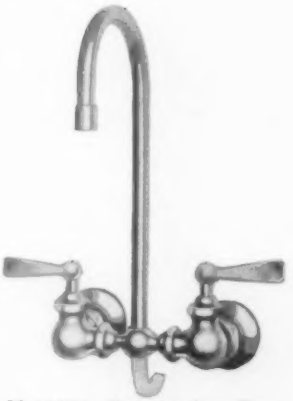
H-12040 Compression Laboratory Stop with detachable hose nipple and tee handle. Inside I.P. Threads



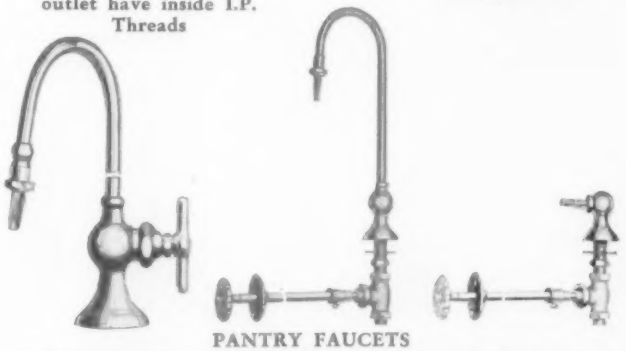
H-12010 Ground Key Laboratory Stop. Flat lever handle. Hose end has tapered corrugations. Inlet at right angle. Inside I.P. thread

Furnished with indexed handles upon request

H-12080 Compression Swing Spout Faucet. Spout swings down into sink. Inlet and outlet have inside I.P. Threads

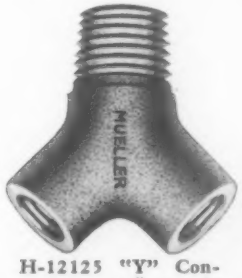


H-12085 Compression Double Swing Spout Faucet. Same as H-12080 except double supplies

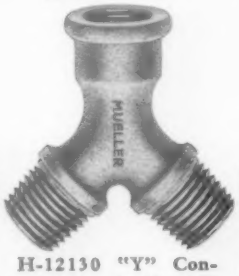


PANTRY FAUCETS

H12090 Four Arm indexed (cold) Faucet regularly supplied
H-12092 Remote controlled with Wheel Handle
H-12093 Remote controlled with Wheel Handle and Turret Top. Can be furnished with one, two, three or four nipples in turret



H-12125 "Y" Connection. ⅜" outside I.P. Thread inlet with ¼" inside I.P. Thread outlet



H-12130 "Y" Connection. Inside I.P. Thread inlet with outside I.P. Thread outlet

H-12145 Nipple with outside I.P. Thread inlet and tapered corrugation for hose outlet

H-12183 Turret with one outlet. Can also be furnished for two, three, or four outlets

Send for a copy of Mueller Laboratory Brass Goods catalog. Fully illustrated with complete data as to sizes and finishes available

CRANE CO.

CRANE Plumbing, Heating, Pumps, Valves, Fittings, Pipe

General Offices: 836 South Michigan Avenue, Chicago 5, Illinois

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS

School Plumbing That Protects Health While Conserving Critical Materials

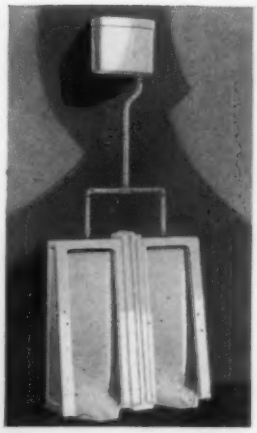
Because they combine maximum utility with a minimum use of critical materials, Crane plumbing fixtures eliminate any need for compromising with accepted standards for school installations. As always, Crane plumbing excels in dependable and durable service. Fixtures are made of genuine, non-critical vitreous china or Crane vitreous glazed Duraclay, both time tested, pre-war materials. Trim is of rugged construction, minimizing the use of vital metals. However, operating efficiency is nowise impaired, as all working parts are brass.

Typical items are shown. Your local Plumbing Contractor or Crane Branch will gladly advise you regarding proper selection of equipment for replacement or new installations.

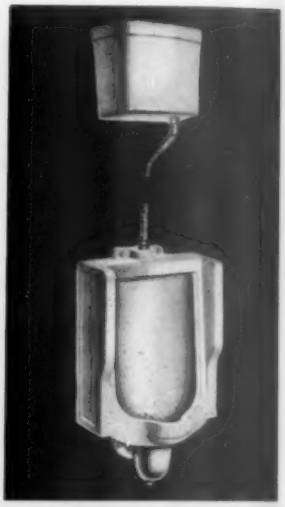
IMPORTANT — Educational institutions may automatically apply a priority rating of AA-2 (or allotment symbol "MRO") when ordering plumbing and heating materials for maintenance and repairs. This is authorized by CMP Reg-5-a. Any Crane Branch will be glad to furnish a copy of the official text of this regulation.

Cottage Duraclay two-compartment apron sink with 6-in. back. May be had with hardwood reversible drainboard. Size 42 x 20". Catalog No. CE 19-563

Yorkshire vitreous china lavatory with raised shelf back; has single-spout mixer faucet, chain and stopper. Size 18 x 15". Catalog No. CE 625



Sanitor vitreous china, slope-front urinal stalls with china tank. Automatic flushing. Overall width each unit 18". Catalog No. CE 15-390



Correcto vitreous china, washout wall urinal with china tank. Automatic flushing. Overall width 18". Catalog No. CE 15-601

Galvanized iron, exposed 2-valve gooseneck shower with Economy shower head. Has reversible yoke for supply from ceiling or floor. Catalog No. CE 4418

Santon elongated rim, siphon-jet closet with concealed pressure tank and seat-operated flush valve. Has open-front wood seat. Catalog No. CE 12-096

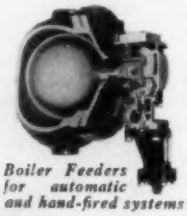
Thurstond vitreous china drinking fountain with regulating screw and self-closing valve. Has vanda'-proof base, integral strainer, angle stream jet. Catalog No. CE 9161

Rapidway blow-out wall-type closet with elongated rim, flush valve and vacuum breaker, and with open-front plastic seat. Catalog No. CE 11-380

HEATING EQUIPMENT FOR REPAIRS AND MAINTENANCE

Crane offers a complete line of modern heating equipment and specialties for the repair and maintenance of all types of school heating systems. Insure maximum heating efficiency and winter comfort for your school by making necessary repairs now. Call your Crane heating contractor or Crane Branch.

Sectional Boilers, up to 3,840,000 Btu. net capacity



Boiler Feeders for automatic and hand-fired systems

Low-pressure Pop Safety Valves for steam boilers

Coal Stokers, from 60 to 350 pounds-per-hour capacity

Radiator Venting Valves for all type systems

The PHILIP HAAS CO.

Dayton 2, Ohio

Haas Automatic Pressure Tank Closets

Haas Automatic Pressure Tank Closets with MASTER Valve, Models 700 to 707, are specially designed for installation in schools and public institutions. Extremely durable, they combine the demand for water saving with that for automatic flush.

All combinations are equipped with the Haas MASTER Valve, an extremely simple, practical device which operates easily and surely, delivering a maximum of service at a minimum of upkeep cost. (When desired, old bowls can be equipped with these up-to-the-minute valves.)

BOOKLET AND PRICE LIST AVAILABLE ON REQUEST

NO. 700

NO. 701

WASHDOWN COMBINATIONS

NO. 706

SYPHON JET COMBINATIONS

NO. 702

NO. 703

NO. 707

Both Washdown and Syphon Jet Combinations include the Haas MASTER Seat Action Valve, sanitary open front and golden oak seat with reinforced hinge.

WASHDOWN COMBINATIONS

No. 700 has 8" x 24" galvanized pressure tank and extra heavy twice-fired vitreous china washdown bowl.

No. 701 is same as No. 700 but with 30" galvanized flush pipe.

No. 706 is same as No. 700 but with connections for concealing tank in the wall (as pictured).

SYPHON JET COMBINATIONS

No. 702 has 8" x 30" galvanized pressure tank and heavy twice-fired top spud, regular rim vitreous china syphon jet bowl.

No. 703 is same as No. 702 but with 30" galvanized flush pipe.

No. 707, same as No. 702 but with connections for concealing tank as shown.

THE EBCO MANUFACTURING CO.

401 West Town Street
Columbus 8, Ohio

Manufacturers of

Oasis and Ebco Electric Water Coolers and Drinking Fountains

OASIS and EBCO Electric Water Coolers and Drinking Fountains lead the field in utility, economy, and durability in school equipment of this type. Like any high quality product, the units shown on this page reflect in every detail of design the specialized experience and modern manufacturing facilities of the progressive organization back of them. And as a pioneer in the water cooler field EBCO not only has many years of specialized designing background but also has one of the largest and best equipped conveyor-line production plants in the industry. By those who know construction and operation details OASIS and EBCO are always preferred and specified.

Pressure bubbler model with cabinet size: width 17", depth 17", height 40". Finished: Autumn Brown lacquer over baked enamel primer. Base: Black.

Bubbler Valve: Combination self-closing push-button type. Working parts made of non-ferrous metals. One piece bubbler guard and valve shield made of molded plastic.

Glass Filler Outlet: Provides for field installation of glass filler at left rear corner.

Condensing Unit: Equipped with EBCO, approved open type reciprocating ¼ H.P. belt driven, air cooled, super capacity condensing unit. Quiet operation. Motor has automatic overload protection. Furnished standard with 110 volt, 60 cycle, single phase, A.C. motor or 115 volt D.C. motor. Specify motor required.

Capacity: Bubbler capacity over 10 gallons per hour cooled from a tap water temperature of 90° F. to a drinking water temperature of 50° F. in a 100° F. ambient room temperature. Storage capacity—15 quarts.

Auxiliary Connection: For remote bubbler use, a ⅜" I.P. outlet is furnished in rear of cabinet.

GENERAL SPECIFICATIONS

Cabinet: Fabricated of corrosion resisting steel, wrap-around welded construction, back and side panels in one piece. Bottom of front panel removed for service.

Top: Over-hanging type, white acid-resisting finish. Anti-splash ridge integral with top.

Cooling Tank: Direct rapid cooling, storage tank type. Evaporator is submerged inside the pressure tank. This low-side is furnished with patented by-pass relief line which prevents bursting or distortion of pressure tank caused by mechanical freeze up. Equipped with refrigerant heat exchanger.

Precooler: Counter flow type. Warm inlet water flows through a coil. Cold waste water cascades over the coil and precools the warm inlet water.

Insulation: Two inches or more of mineral wool and completely sealed from air currents with hot hydrolene.

Controls: Liquid refrigerant controlled by an automatic adjustable expansion valve, fully insulated. Water temperature maintained by an off-and-on adjustable automatic thermostatic switch.

Plumbing Connections: Inlet water connection ⅜" I.P. size female thread; 1¼" female pipe thread drain connections. Remote bubbler connection ⅜" female pipe thread. All connections located in rear of cabinet.

All specifications subject to change without notice

Cafeteria glass filler model with cabinet size: width 28", depth 24", height 42". Finished: White lacquer over baked enamel primer. Base: Black.

Glass Fillers: Equipped with 2 EBCO C-550 platform operated self-closing glass fillers.

Condensing Unit: Equipped with EBCO approved open type reciprocating twin cylinder, ¾ H.P. belt driven air cooled super capacity condensing unit. Quiet operation. Motor has automatic overload protection. Furnished standard with 115 volt, 60 cycle, single phase A.C. motor. Also available with 115 volt, 3 phase, 60 cycle, A.C. motor and starter or 115 volt or 230 volt D.C. motor.

Capacity: This cooler will supply more than 40 gallons of 50° F. drinking water over a 2 hour period when operating in a 100° F. ambient room temperature reducing the drinking water from a tap water temperature of 90° F. Storage capacity over 10 gallons.

Auxiliary Connection: For remote bubbler use, a ⅜" I.P. outlet is furnished in rear of cabinet.

No. V-255 Bracket Fountain. Oasis white Vitreous chinaware wall Bracket Fountain, for direct connection to pressure water lines or as a remote drinking fountain connected to an electric water cooler.

Bubbler Valve. EBCO No. 9000 combination angle stream self-closing bubbler valve with automatic pressure control. Push button operated furnished with ⅜" stop valve and supply line to wall.

Dimensions: Receptor size: 11" long x 7" wide with a projection of 11⅛" from wall. Trap size: 1¼" I.P. Inlet water connection: ⅜" I.P.

No. C-500 Glass Filler—Carafe type push-button operated with gooseneck and self-closing valve. Material is brass and finished in chrome plate. ⅜" I.P. size.

No. C-550 Glass Filler—Cafeteria type platform operated with gooseneck and self-closing valve with volume control. Material is brass and finished in chrome plate. ⅜" I.P. size.

No. C-250-N Bracket Fountain for use as a remote drinking fountain for Electric Water Coolers.
Receptor: Rigid cast iron properly annealed and finished with EBCO acid-resisting white Vitreous porcelain enamel.
Bubbler Valve: EBCO No. 9000 combination angle stream self-closing bubbler valve with automatic pressure control. Push button operated furnished with ⅜" stop valve and supply line to wall.
Dimensions: Receptor size: 10" long x 5" wide with a projection of 9½" from wall. Trap size: 1¼" I.P. Inlet water connection: ⅜" I.P.

SPECIFY EBCO QUALITY AND YOU'LL BE SURE OF THE BEST

THE HALSEY W. TAYLOR CO.

Manufacturers of Drinking Fountains and Coolers

Warren, Ohio

AGENTS IN PRINCIPAL CITIES

PRODUCTS

Halsey Taylor Drinking Fountains; Combination Cooler Drinking Fountains in Iced Water or Electric Types.

DISTINCTIVE FEATURES THAT APPEAL TO ARCHITECT AND SCHOOL AUTHORITIES ALIKE

It was during the first World War that Halsey Taylor Drinking Fountains were introduced. Today, they are still accepted among the country's foremost fountains, because of their modern design, their distinctive patented features that spell convenience and sanitation alike, and their wide variety of models from which to choose. That is why they are still a preferred specification of architects and builders, whether for schools or other public buildings; industrial plants, hospitals or churches.

You buy more than a mere fountain when you buy Halsey Taylor Drinking Fountains. You buy definite assurance of trouble-free service, positive health-safety, maximum convenience, built-in patented features exclusive with Halsey Taylor!

It is in school operation that a fountain finds its greatest use as a factor in hygiene. When pupils drink from Halsey Taylor Fountains day after day, it is this assurance of health-safety that more than pays for the care in selecting the right make of fountain—and that make usually is Halsey Taylor, practically a standard in school installations the country over. Their most valued features are:

1 — Practical Automatic Stream Control

An automatic device maintains constant height in drinking stream regardless of line pressure variation. Stream never too high, never too low.

2 — Ideal Drinking Mound

The two-stream projector with latest type guard makes the side stream both practical and health-safe, removing objections found with ordinary side-streams.

3 — Definite Sanitation

Drinking mound is formed by the converging of two streams of water, setting up a localized drinking mound which makes it impractical to drink from any other point but the ideal height of the mound. Fingers or lips cannot come in contact with or contaminate water source. It is impossible to squirt the water.

Pedestal Type—No. 3916

No. 3914

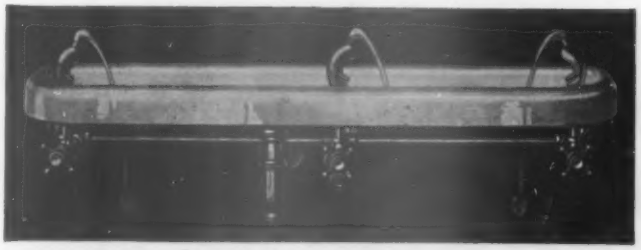
No. 3901

One of many attractive pedestal and wall types

Battery Types

Many two- and three-part battery types especially adapted to school installations

No. 3912



No. 2703

FOUNTAINS FOR EVERY REQUIREMENT

These pages show a few of the various types of Halsey Taylor Drinking Fountains. There are many models from which to select, all most modern in styling, all with the fundamental Taylor features. Send for catalog.

GENERAL ELECTRIC COMPANY

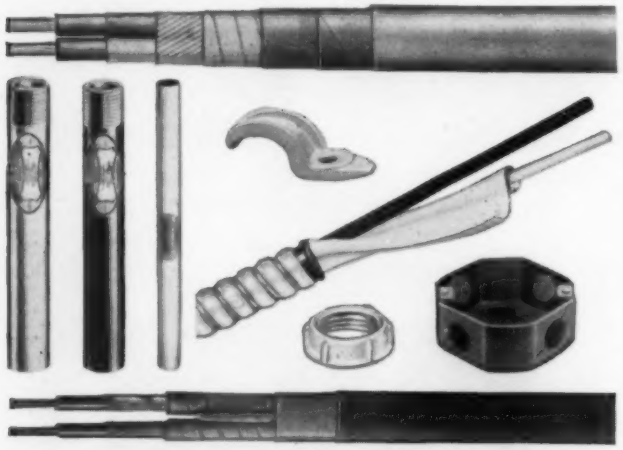
APPLIANCE AND MERCHANDISE DEPARTMENT

Bridgeport, Connecticut

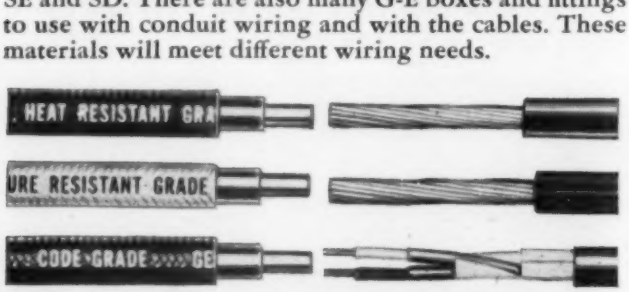
Wiring Materials for Complete Wiring Systems In Schools and Colleges

Good electrical wiring is of first importance in modern schools and colleges. Lighting depends on it. Electrical equipment in laboratories, auditoriums, offices and service rooms also depends upon it. Adequate wiring systems should be installed in new buildings, of course, and in many cases the wiring in existing buildings should be modernized. High quality wiring materials should be used to provide long, trouble-free service and to avoid expensive repair and replacement jobs.

G-E WIRING MATERIALS G-E wiring materials are good materials to use because they are carefully made of the finest raw materials. They have uniform high quality and will give long, dependable service. The line includes conduit products, wires and cables and wiring devices—all the materials needed for wiring any school or college building.

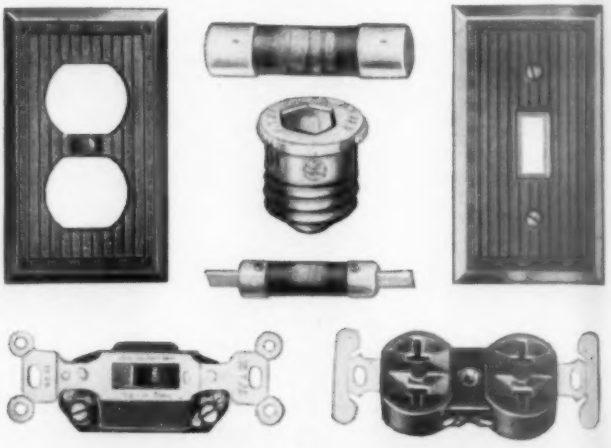


G-E CONDUIT PRODUCTS Here are zinc-coated G-E White rigid conduit, enamel-coated G-E Black rigid conduit, electrical metallic tubing, two standard cables —BraidX and BX and service entrance cables—Types SE and SD. There are also many G-E boxes and fittings to use with conduit wiring and with the cables. These materials will meet different wiring needs.



G-E WIRES AND CABLES In this high quality line are thermo-plastic insulated Flamenol* building wires, Type SN for general purpose wiring and Type SNW for wiring in wet locations. These wires are small in diameter, resistant to oils, acids and alkalies and are flame retarding. Other wires in the line include Type R, Code Grade; Type RH, Heat Resistant Grade; and Type RW, Moisture Resistant Grade. There are also a variety of portable cords.

**Reg. U.S. Pat. Off.*



G-E WIRING DEVICES There are literally hundreds of G-E wiring devices—switches, convenience outlets, plates, lampholders, enclosed cartridge fuses, plug fuses, etc. All of these devices are high quality. They are ideal for serving, controlling or protecting lighting or electrical appliances or equipment.

G-E FLUORESCENT ACCESSORIES General Electric manufactures a complete line of fluorescent accessories which consists of starters, lampholders and starter sockets. G-E lampholders and starters are available for all types of fluorescent lamps ranging from mogul to miniature sizes.

FOR FURTHER INFORMATION

on G-E Conduits, Wire and Cables, Wiring Devices or fluorescent accessories, see the G-E Merchandise Distributor near you or write to Section CDW5510-141, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

FOR UNDERFLOOR ELECTRICAL DISTRIBUTION

General Electric offers two types of underfloor wiring. Both give almost unbelievable electrical flexibility. This method of wiring is particularly suited for laboratories, libraries, offices, work shops, etc. With it electrical outlets can be preset or added later as they are needed. Lights and equipment can be changed at will. High- and low-tension service can be accommodated.

Specify G-E Fiberduct with Masonry and Wood Type Construction

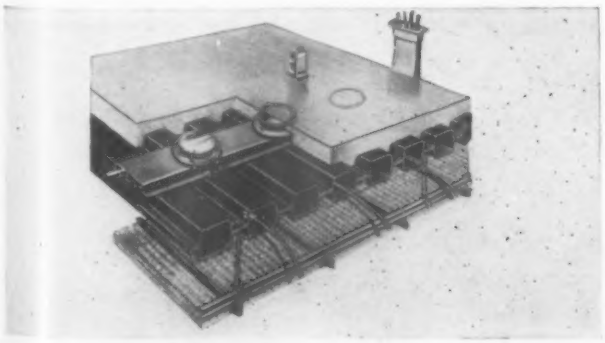
Here G-E Fiberduct underfloor raceways are being installed in a triple grid layout. Note conduit connection between Fiberduct and panel board.

This high school laboratory has G-E Fiberduct raceways under the floor. All machines are fed from the Fiberduct Underfloor Wiring System.

Specify G-E Q-Floor Wiring with Robertson Q-Floors

G-E Q-Floor Wiring installation. Header ducts are shown running across the cells of the floor at right angles. The header ducts are feeder raceways for conductors to reach cells. Outlets are installed in cells.

Here outlets are shown at every desk served by G-E Q-Floor Wiring.



Cutaway diagram of G-E Q-Floor Wiring showing floor cells, header duct and outlet. Outlets can be placed anywhere over cells carrying wires.

Additional Information

For further information on G-E Fiberduct underfloor raceways and on G-E Q-Floor Wiring for Robertson Q-Floors, see the nearest G-E Merchandise Distributor or write to Section CDW5510-141, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

THE ELECTRIC STORAGE BATTERY COMPANY

World's Largest Manufacturers of Storage Batteries for Every Purpose

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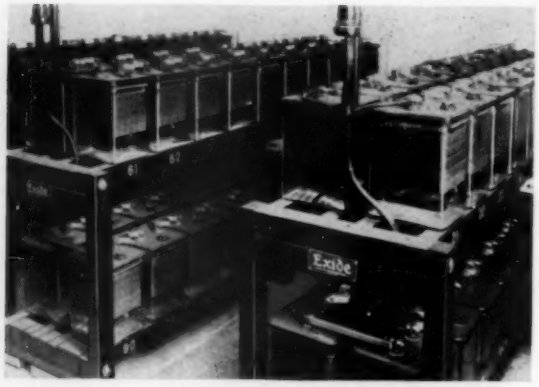
New Orleans 12, 432 Balter Bldg.
New York 18, N. Y., 23-31 West 43rd St.
Philadelphia 32, Pa., 17th St. & Indiana Ave.
Pittsburgh 19, Pa., 596 Union Trust Bldg.
St. Louis 3, Mo., 1218 Olive St.
San Francisco 24, Calif., 6150 Third St.
Seattle 4, Wash., 1919 Smith Tower Bldg.
Washington 6, D. C., 1819 L St., N. W.

In Canada: EXIDE BATTERIES OF CANADA, LIMITED, 153 Dufferin St., Toronto



The Exide Chloride Battery in The Research Laboratory of Physics, Harvard University. It is used for general service

FOR LABORATORIES, FIRE ALARM, PROGRAM CLOCKS, AUTO-CALL AND INTERIOR TELEPHONES

Exide Batteries are extensively used in the laboratories of the nation's foremost scientists, industrial research engineers, schools and colleges. Their performance records are the best testimony that can be offered as to their merit for laboratory services.

The foremost characteristics of Exide Batteries are absolute dependability and sustained high voltage until end of discharge. The operation of Exide Batteries is flexible. Cell connections to the battery can be arranged so as to give any desired voltage, with a wide range in discharge rates available at that voltage. By assigning a group of cells of the battery to a definite experiment, a constant voltage is assured which is free from disturbance or interference by any outside influence.

Exide Batteries of the sealed glass jar type have been carefully designed and are carefully constructed for laboratory service. They assure exceptional long life in laboratory service. Many Exide Chloride Batteries in laboratory and industrial installations have been in constant use for 20 or more years.

Regardless of how limited your budget appropriation, an Exide Battery can be selected to meet your requirements. Moreover, the wide experience of Exide engineers and the services of our nation-wide Exide organization are at your disposal. Write to the nearest Exide office shown above for further information.

EXIDE EMERGENCY LIGHTING

Positive Protection Against Dangers of Sudden Lighting Failures

Either children or adults, you can never predict the actions of a crowd that is suddenly plunged into darkness. Danger is real. Danger of personal injury . . . danger to school property.

The utility companies take every precaution, but cannot control the effects of storms, floods, fires, and street accidents. Privately-owned plants, no matter how carefully planned and operated, may also have interruptions.

The only certain safeguard is an emergency lighting system that functions both instantly and automatically.

Electrical engineers agree that a storage battery, properly **maintained,** constitutes the most dependable source of emergency power.

During an electric service interruption, Exide Keepalite furnishes the power from a dependable Exide Battery to the lights in auditoriums, gymnasiums, corridors exits, fire towers, stairways, engine rooms, locker rooms, swimming pools, dormitories, laboratories, etc.

Exide Batteries have been used in emergency service, by telephone, railroad and public utility companies since 1895. The new Exide Keepalite control equipment, which automatically keeps the battery properly maintained, represents the qualifications found desirable from the experience of more than 3000 installations in all kinds of buildings.

The exceptionally long life obtained from Exide Chloride Batteries used with the Exide Keepalite System assures many years of dependable emergency lighting service.

A typical Exide-Keepalite System with a 60-cell Exide Battery and Control Unit. It operates instantly and automatically. The infrequent addition of water to the battery is the only maintenance required

Exide
BATTERIES

GRAYBAR ELECTRIC COMPANY, INC.

Executive Offices: Graybar Building, New York 17, N. Y.

CONVENIENT LOCAL SERVICE FROM OFFICES IN OVER 80 PRINCIPAL CITIES

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Albany, N. Y.	Detroit, Mich.	Nashville, Tenn.	Sacramento, Calif.
Allentown, Pa.	Duluth, Minn.	New Haven, Conn.	St. Louis, Mo.
Asheville, N. C.	Durham, N. C.	New Orleans, La.	St. Paul, Minn.
Atlanta, Ga.	Flint, Mich.	New York, N. Y.	Salt Lake City, Utah
Baltimore, Md.	Ft. Worth, Texas	Newark, N. J.	San Antonio, Texas
Beaumont, Texas	Grand Rapids, Mich.	Norfolk, Va.	San Diego, Calif.
Birmingham, Ala.	Hammond, Ind.	Oakland, Calif.	San Francisco, Calif.
Boston, Mass.	Harrisburg, Pa.	Oklahoma City, Okla.	Savannah, Ga.
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Chicago, Ill.	Jacksonville, Fla.	Philadelphia, Pa.	Syracuse, N. Y.
Cincinnati, Ohio	Kansas City, Mo.	Phoenix, Ariz.	Tacoma, Wash.
Cleveland, Ohio	Knoxville, Tenn.	Pittsburgh, Pa.	Tampa, Fla.
Columbia, S. C.	Lansing, Mich.	Portland, Me.	Toledo, Ohio
Columbus, Ohio	Los Angeles, Calif.	Portland, Ore.	Washington, D. C.
Corpus Christi, Texas	Louisville, Ky.	Providence, R. I.	Wichita, Kan.
Dallas, Texas	Memphis, Tenn.	Reading, Pa.	Winston-Salem, N. C.
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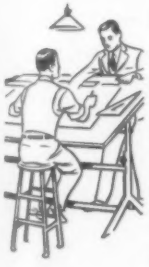
AN ALL-INCLUSIVE ELECTRICAL SUPPLY SERVICE FOR SCHOOLS AND UNIVERSITIES

Through its nationwide network of warehouses and offices, GRAYBAR distributes the products of more than 200 of the nation's leading manufacturers of electrical equipment and supplies. Its services are based on 75 years of experience in the electrical field.

Experienced GRAYBAR representatives and field specialists can perform unusually useful functions for the school architect, the electrical contractor, and the buyer of electrical maintenance supplies – going far beyond mere "order-taking."



AID FOR POST-WAR PLANNING

GRAYBAR is fully informed on modern equipment for school lighting, communication, signaling and alarm systems. Specialists familiar with school installations in other communities will advise on choice of equipment and planning of the system.

SERVICE ON ESSENTIAL SUPPLIES

GRAYBAR representatives can help your staff meet wartime difficulties in processing the electrical products necessary to keep going. From their broad knowledge of electrical supply sources and equipment they can almost always suggest alternates for unavailable items. 3513

PRODUCTS LIKE THESE COME FIRST *VIA GRAYBAR*

ALARM SYSTEMS • ANNUNCIATORS • APPLIANCES • AUDIOMETERS • BATTERIES • BELLS • BUZZERS • CABLE • CALL SYSTEMS • CIRCUIT BREAKERS • CLOCKS • COMMUNICATION • CONDUIT • CONTROLLERS • CORDS • DRY CELLS • FANS • FITTINGS • FIXTURES • FLOODLIGHTS FLUORESCENTS • FUSES • HEARING AIDS • HORNS • INSTRUMENTS • INTER-PHONES • JUNCTION BOXES • LAMPS • LUMINAIRES • METERS MOTORS • PLUGS • PANELBOARDS • OUTLETS • RANGES • RECEPTACLES • RECTIFIERS • REFLECTORS • SIGHTMETERS • SIGNALING • SIRENS SOCKETS • SOUND SYSTEMS • STREET LIGHTS • SWITCHES • TAPE • TELEPHONES • TESTERS • TRANSFORMERS • TOOLS • VOLTMETERS • WIRE

ULTRAVIOLET GERMICIDAL RADIATION SYSTEMS

HOLOPHANE COMPANY, INC.

342 Madison Avenue
New York City

PLANNED LIGHTING *for Every School Need . . .*

In-Bilt Classroom Lighting

Classroom Lighting with Pendent Units

Special Lighting Service Arcade

Ideal Gymnasium Lighting

THOUSANDS of public and private schools and colleges throughout the United States are Holophane lighted. The systems employed represent 50 years of leadership in the lighting industry based on proven methods and continued research which assures the best in lighting technique.

For every area in the school there is a Holophane lighting unit ***specifically*** designed to provide the most adaptable illumination for the purpose. Holophane Planned Lighting is effective, efficient, economical. Each ***specific*** can be depended on to produce the greatest amount of useful light. There is no permanent depreciation of the prismatic glass light controlling surface and temporary depreciation is a minimum.

School executives, board members, architects and engineers are invited to avail themselves of Holophane's free Engineering Service to determine the best type of lighting for their school needs.

— SEND US YOUR PLANS TODAY! —

Blackboard Lighting with Controlenses

Music Room Lighted with Controlenses

Gymnasium Lighted with Hibay Reflectors

MOST communities are now formulating their postwar school building plans. The selection of suitable lighting is an important factor. Today, with so many variable factors affecting so important a decision, it is vital that expert assistance be obtained.

Holophane engineers will gladly study your proposals and submit complete recommendations as to type of equipment, light source, and proper lighting levels to assure continued efficient, effective, economical lighting.

LET US HAVE A PART IN YOUR POSTWAR PLANS

Holophane
COMPANY, INC.
Lighting Authorities—Since 1898
342 MADISON AVE.
NEW YORK CITY
THE HOLOPHANE CO. LTD.
385 Yonge St., Toronto, Canada

Manual Training Classroom Lighted with Holophane Lobay Industrial Reflectors

Auditorium Lighted with Holophane In-Bilt Controlenses

THE F. W. WAKEFIELD BRASS COMPANY

1945 Yearwood Park, Vermilion, Ohio

Over Thirty Years a Manufacturer of Lighting Equipment

DISTRIBUTORS IN 108 CITIES

"Hang the sky" in postwar classrooms . . . lighting by

WAKEFIELD

. . . filament or fluorescent

. . .

The COMMODORE

for filament lamps

Glareless, indirect light

Molded from Plaskon

Low maintenance cost

Also comes with "Star" shade

SCIENTIFICALLY designed to give the right light for easy seeing and eyesight protection, the Wakefield COMMODORE can help you "hang up the sky" for overall light in classrooms. With its simple, lightweight shade, molded from Plaskon, the COMMODORE also brings users these important advantages: 1. Unusually efficient indirect light; 2. Easy cleaning; 3. High degree of safety; 4. Far less breakage; 5. Low maintenance cost; 6. Smart, modern appearance. Why not make the COMMODORE part of your modernizing plans?

Guarding eyesight has new importance now, with wartime adult-training classes meeting in schools. COMMODORES provide 30 footcandles of diffused light for such a class at the Case School of Applied Science

HOW THE COMMODORE HELPS GUARD SIGHT

According to Electrical Testing Laboratories, famous New York research and testing organization, the COMMODORE gives 86% of the light from the bare bulb. That means more light than most indirect fixtures . . . and it is soft, generous, diffused light . . . to make seeing easier, put far less strain on young eyes. For best results, light colored ceilings are necessary.

MODERNIZES SCHOOLROOMS OVERNIGHT

Night classes resulting from wartime educational and rehabilitation programs emphasize the necessity for better lighting in many a school and college. The COMMODORE provides a practical answer since it can modernize seeing conditions at once . . . quickly makes your worst-lighted room your best lighted. It provides new eyesight protection on dark days, too.

Incidentally, better light from the COMMODORE'S simple, modern design not only makes a world of difference in the appearance of the room but in the attitude of the people in it! They are more attentive; study more effectively; and feel fresher, in rooms lighted with COMMODORES.

SEE THE DIFFERENCE . . . before and after
Here in one unretouched photograph you see a striking comparison of lighting results. Taken from outdoors it shows at a glance how the COMMODORE improves seeing conditions. Upper room in this Ashland, Ohio, school lighted with old units; lower room with COMMODORES

WRITE FOR INTERESTING BOOKLET

Filled with case histories from schools all over the country, this booklet offers tested suggestions on how to have better light . . . outlines factors to watch in addition to lighting . . . pictures the results obtained. Send for your copy.

If you're thinking about FLUORESCENT **. . . let us help you. Many a school, prevented from having fluorescent lighting by the war, is thinking of it for post-war applications . . . because of its highly successful use in war production. Wakefield pioneered in fluorescent lighting for school use, has continued to make equipment for essential war needs. And we can assure you that, postwar, Wakefield fluorescent equipment will include all the latest developments of lighting research and engineering. We will be glad to give you or your architects the benefit of our experience in planning for tomorrow.**

TYPICAL WAKEFIELD UNITS

THE GRENADIER — THE ADMIRAL — THE BEACON — THE DIPLOMAT

The EDWIN F. GUTH CO.

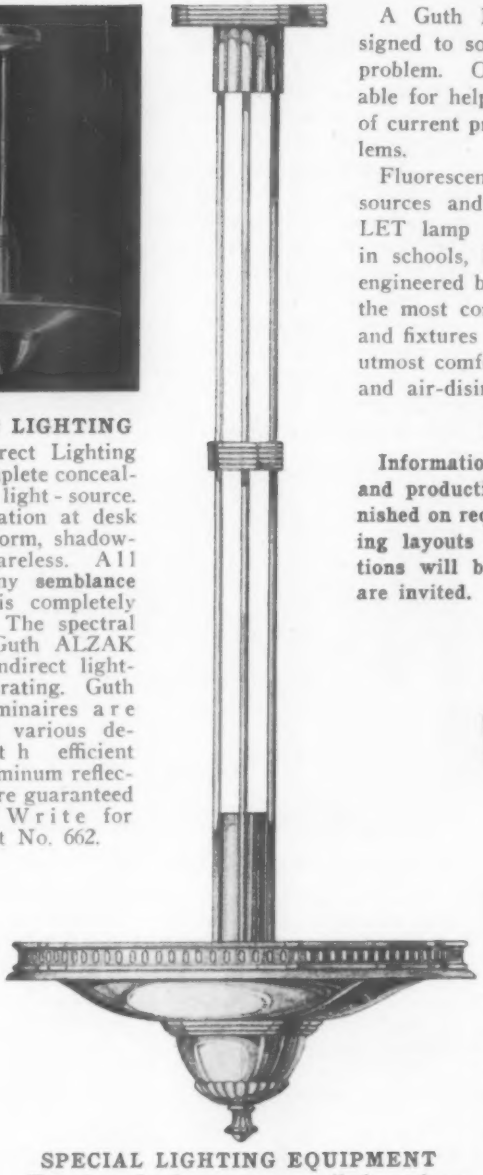
"Leaders In Lighting Since 1902"

FLUORESCENT and INCANDESCENT LIGHTING

2615 Washington Ave.
St. Louis 3, Mo.
Phone: JEfferson 3200

INDIRECT LIGHTING

Guth Indirect Lighting provides complete concealment of the light-source. The illumination at desk level is uniform, shadowless and glareless. All glare, or any **semblance** of glare is completely eliminated. The spectral quality of Guth ALZAK Aluminum indirect lighting is exhilarating. Guth Indirect Luminaires are available in various designs with efficient ALZAK Aluminum reflectors which are guaranteed permanent. Write for Guth Booklet No. 662.



SPECIAL LIGHTING EQUIPMENT

For the school entrance, vestibule and entrance exterior write for Guth special designs. Our designing and engineering departments are readily available to supply these designs and quote you prices.

A Guth Luminaire has been designed to solve every school lighting problem. Our engineers are available for helpful services and solution of current problems, or postwar problems.

Fluorescent and Incandescent light sources and the new ULTRA-VIOLET lamp for control of contagion in schools, have been pioneered and engineered by Guth. To-day we offer the most complete line of luminaires and fixtures for proper utilization and utmost comfort for all school lighting and air-disinfecting problems.

INQUIRIES

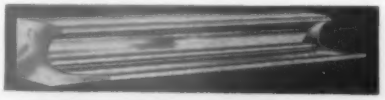
Information regarding our products and production facilities will be furnished on request. Complete engineering layouts and unbiased considerations will be given. Your inquiries are invited.

GUTHFANS

GUTHFAN — "Cools You All Over" — the healthful way. Its complete-cycle, air-circulation keeps the room-air always fresh, moving and stimulating. No direct blasts, or drafts. Write for Catalog No. 8.

FLUORESCENT LIGHTING

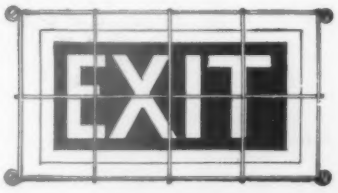
Guth Fluorescent Luminaires are available for schools in various types including glass-diffusing, lamp-shielding (Egg-crate types), exposed-lamp types and totally indirect Fluorescent. Guth Fluorescent can be mounted directly to the ceiling, or suspended on hangers. Write for Catalog No. 44, for full information and complete engineering details.



"GERM-KILLING" FIXTURES

For Air-Disinfection

Guth ULTRA-VIOLET fixtures are for use with the new Germicidal lamps which kill air-carried bacteria. ULTRA-VIOLET reaches germs by the simplest, most efficient method possible. Helps control epidemics of colds, Flu and childhood maladies. Write for Guth Folder 758 for complete layout details.

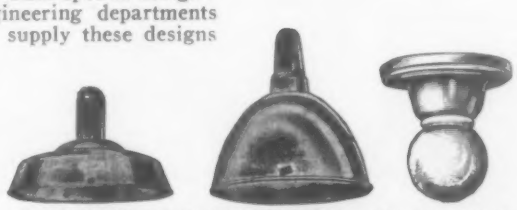


EXIT AND DIRECTIONAL SIGNS

All types of exit, rest-room and gymnasium signs; also special designed signs available. Write for Catalog No. 41.

RECESSED LIGHTING

For the auditorium, hall or classroom; for Incandescent or Fluorescent lamps; write for full details.



GYMNASIUM REFLECTORS — GLASS GLOBE LIGHTING

For High-Bays in Gymnasiums. For efficient lighting in manual training and vocational areas. Also glass-globe lighting in class-rooms; utility type fixtures; write for Guth Catalog No. 44.

GUTH QUALITY

"LEADERS IN LIGHTING SINCE 1902"

St. Louis 3, Mo.

WESTINGHOUSE ELECTRIC CORPORATION

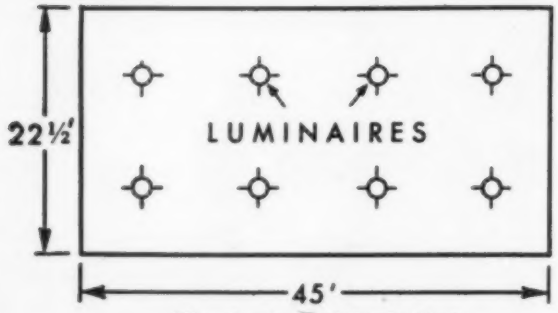
Cleveland, Ohio

ENGINEERED "SEE-ABILITY"...

with Modern School Lighting Equipment

Better "See-ability" for Study Halls

Correct lighting encourages concentration, permits close study without eyestrain. In this installation, eight Westinghouse Magnalux luminaires—outside row, 300-watt; inside row, 500-watt—provide an initial illumination of 25 foot-candles. Note recommended layout (below) for this 22½ ft. by 45 ft. room, with 12 ft. ceiling. Recommendations include buff-colored walls with white ceiling to obtain maximum lighting efficiency.



Plan for typical Study Hall

"SEE-ABILITY" must be considered as vital a component of modern educational facilities as are books, desks and blackboards. The student depends upon vision to learn the majority of his lessons. Often, backward students have been found to be merely struggling under a handicap of substandard seeing. Therefore, scientific illumination is one of the main requirements in classrooms, study halls, libraries and gymnasiums.

Not only will adequate seeing conditions help the student learn his lessons more quickly, but also conserve his precious sight for more efficient seeing in later years.

Westinghouse engineers have long been active in

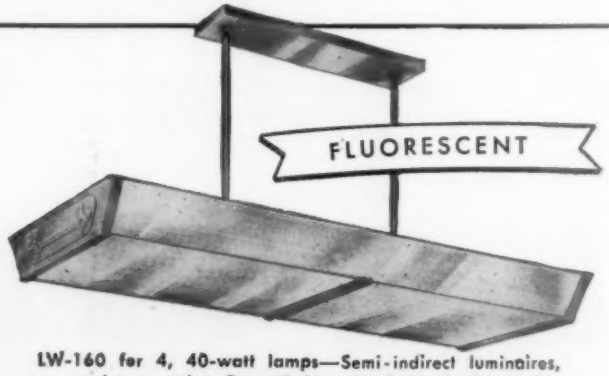
Better "See-ability" for Libraries

Here good lighting invites research or recreational reading. Eight Westinghouse Magnalux 500-watt luminaires meet the versatile demands of this 22½ ft. by 44 ft. reading room with 13 ft. ceiling . . . providing 23 foot-candles illumination. Spacing, type of luminaires, recommended wall and ceiling finish all were engineered through the co-ordinated efforts of the local utility lighting department and by Westinghouse Lighting Engineers.

Luminous indirect luminaires especially adapted for classrooms, study halls, offices, auditoriums and lunchrooms.

PL-500 Plastic Basin Indirect Luminaire—for 300-500 watt filament lamps.

Magnalux Glass Basin Indirect Luminaire—for 300-1000 watt filament lamps.



LW-160 for 4, 40-watt lamps—Semi-indirect luminaires, suspension mounting. Rugged sheet metal chassis. Decorative steel end covers and glass panels. Side glass panels of ribbed diffusing glass; bottom glass panel, clear ribbed glass. Also available with louver bottom. For classrooms, study halls, offices, auditoriums, etc.

BY Westinghouse

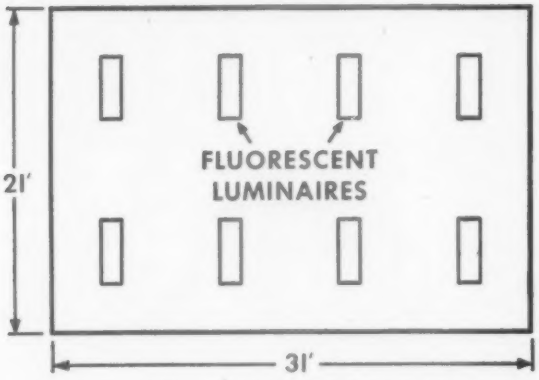
that's DESIGNED RIGHT . . . APPLIED RIGHT

meeting the growing demands for better "See-ability" in schools and universities. Recognizing that mental concentration and perception are seriously handicapped without keen physical vision, these engineers have devoted years of study to the specific lighting needs of the modern educational plant.

Recommendations go far beyond the lighting equipment itself. They include recommended spacing of fixtures, color of walls, ceilings and type of finish. Utilize this Westinghouse experience in your modernization or new construction planning. Contact your local Westinghouse office, or write to Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio. J-04065

Better "See-ability" for Classrooms

Here good illumination protects the precious eyesight of the active youngster against glare or strain. Westinghouse LW-160 Fluorescent luminaires, using layout shown below, provide a maintained average illumination of 45 foot-candles. Walls are painted a pastel green. Ceiling height—13 feet.

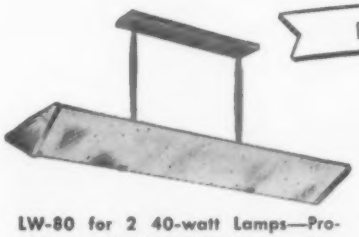


Plan for typical Classroom

Better "See-ability" for Gymnasiums

An important factor in gymnasium lighting is to provide good seeing conditions *at all levels*—for both players and spectators. Equipment must be rugged, to withstand severe abuse. In this installation, Westinghouse engineers recommend 300-500 watt Millite luminaires with wide distribution reflectors—using 500-watt PS-40 inside frosted filament lamps. Mounting height 22 feet. Average horizontal illumination, 20 foot-candles. Mill white finish was recommended for ceiling and trusses to provide reflection factor of 70 to 80%.

FLUORESCENT



LW-80 for 2 40-watt Lamps—Provides semi-indirect illumination. Rugged metal chassis, decorative steel end covers and glass panels of ribbed diffusing glass. For classrooms, study halls and offices, corridors and washrooms.

2FPR-40 for 2 40-watt Lamps—Porcelain enamel steel reflector, fluorescent luminaire, designed for general lighting where precision work is required. Recommended for school shops, home economics departments and science laboratories.

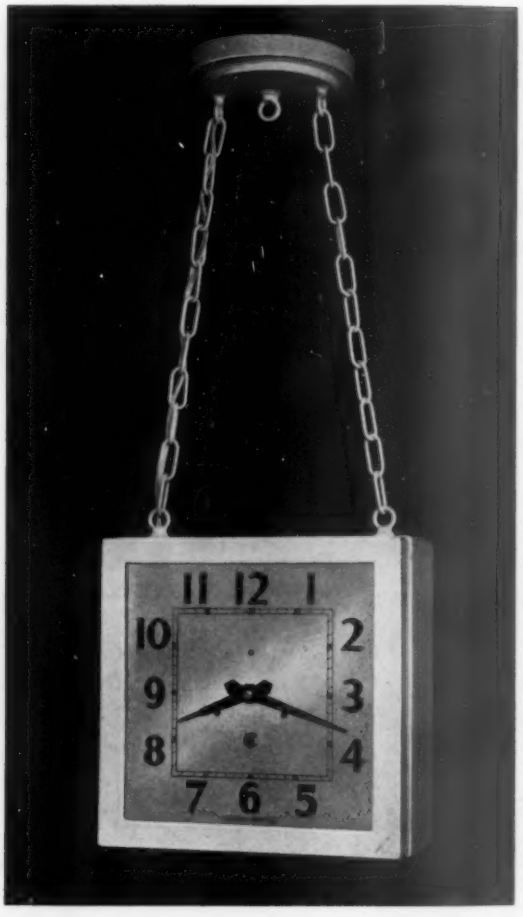
INCANDESCENT

Millite—Incandescent direct luminaire. Provides wide distribution of light with incandescent or mercury lamps. Durable, dust-tight, hinged cover with impact and heat-resisting glass. Easy to maintain. Widely used in school gymnasiums.

THE CINCINNATI TIME RECORDER CO.

Cincinnati, Ohio

CINCINNATI LANDIS



TIME is our BUSINESS!

SCHOOL MANAGEMENT is Big Business. For almost half-a-century CINCINNATI-LANDIS Clocks, Signaling Systems and CTR Time Recorders have provided dependable, accurate service to schools and colleges. Complete information on master and secondary clocks—program machines—push button boards—program bells, buzzers, horns—employees' time recorders—time stamps—synchronous program systems, etc., gladly sent on request.

Consult CTR representatives without obligation regarding your timekeeping, time signaling and time recording problems.

EDWARDS

ELECTRICAL SIGNALING, COMMUNICATION AND PROTECTION EQUIPMENT

EDWARDS AND COMPANY, NORWALK, CONN.

In Canada: EDWARDS AND CO. LTD.

SALES OFFICES AT: Atlanta • Baltimore • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Des Moines • Detroit • Jacksonville • Kansas City • Los Angeles • New Orleans • New York • Omaha • Philadelphia • Pittsburgh • San Francisco • St. Louis • Seattle • Syracuse • Washington, D. C.

★ *CLOCK AND PROGRAM SYSTEMS*

★ *SCHOOL TELEPHONE SYSTEMS*

★ *SCHOOL FIRE ALARM SYSTEMS*

GENERAL PRINCIPLES TO GUIDE YOUR CHOICE OF CLOCKS, PROGRAMS AND SIGNALS

Edwards and Company manufactures a wider selection of signaling equipment than any other manufacturer and the purpose of this listing is to show briefly the best, the most practical and most dependable. That does not mean the most expensive. Instead of confusing you with many alternatives, we give you here a dependable recommendation based on years of research. Some explanations follow: Synchronous Clocks show the correct time at each second of the day and night, are noiseless and dependable. They are a logical and modern advance over the old "minute jumper" clocks which were noisy and only changed time at each minute. Automatic Resetting with dual motored clocks is ideal, and represents a minute fraction of the cost of any up-to-date building. A janitor travelling from room to room with a step ladder is a long and undependable process. Manual correction from a central control is frequently used where initial cost is important. Correction by overspeeding a single motor clock is an unnecessary strain on wearable parts.

A Program Instrument is the only way to assure smooth, systematic and punctual change of classes in any school no matter how small. To omit it and depend upon a principal or student pushing buttons at the right moment is false economy. Flush 12" Clocks are recommended. They cost no more than surface clocks, and a well designed building deserves their neater appearance. The 12" size has proved to be best for most locations.

Room Signals should be loud enough but not startling. The old idea of very loud corridor signals (and no room signals) is distinctly outmoded, first because noisy schools are inefficient schools, and also because all rooms do not change at the same time. A chime is best, a buzzer in the clock case next best.

Loud signals should be used in such locations as gymnasiums, lavatories, swimming pools, vocational rooms and outdoors. A 6" bell is best, a horn second best. Outdoor signals should be watertight, insect-proof, and built to stand abuse. A guard may be used to prevent birds nesting.

Avoid Confusion. There is no economy in trying to make one system do three jobs poorly instead of one job well. Don't try to make program bells call the teacher to the telephone; don't risk lives by having "three rings" on classroom bells warn of fire instead of having a fire alarm system designed for the job.

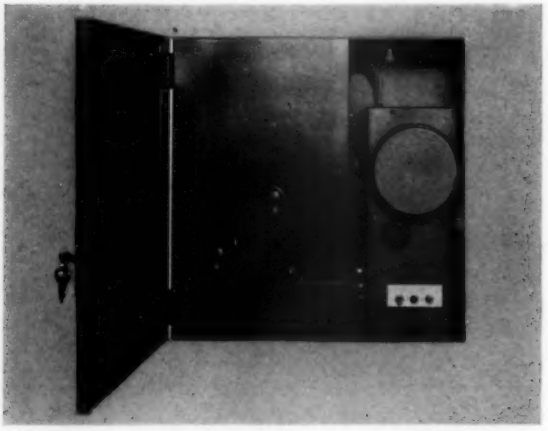
Edwards No. 1115 flush wall clock for new buildings.

Edwards No. 1128 double dial clock for corridors, etc. Suspended from ceiling or side wall as desired.

Edwards No. 1121 surface clock for existing buildings.

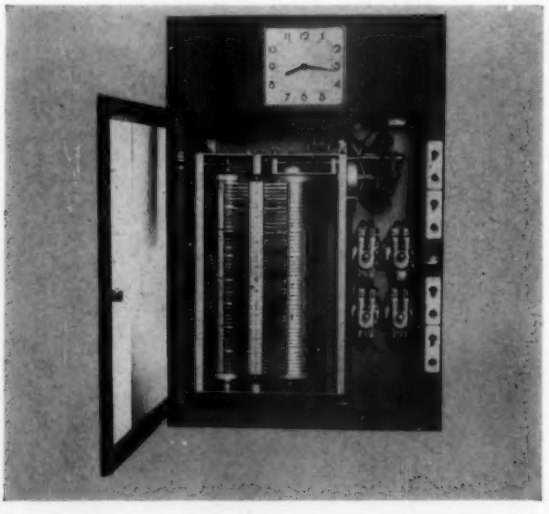
See following pages of description for other signaling equipment

PROGRAM INSTRUMENTS — CONTROL UNITS



CLOCK SYSTEM CONTROL

When clocks, signals and instruments operate as a system with common current supply, the central control permits easy, accurate correction for power interruptions. The Automatic Control measures length of power interruption and causes clocks to operate from a second motor at an accelerated rate to correct time. Unit includes manual switches for daylight saving time corrections. Edwards No. 1101 automatic control is enclosed in metal cabinet with lock and key. Dimensions 18" x 18" x 6" deep. For flush mounting, add 4" to height and width, and allow 5½" depth for box. Also available in manual control type No. 1100. Details on application.



PROGRAM INSTRUMENTS

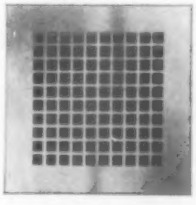
If every room in the school operates on the same schedule (or program) every day in the week, a one-circuit program instrument will suffice. An additional circuit is necessary for every day that the schedule differs and when any grades operate on a different daily schedule. If the school has only daytime sessions, the 12-hour program will suffice. If the school operates on any night schedule, a 24-hour program is required. The multiple-circuit program instrument is available in 2, 4 and 6 circuit sizes. Program is set by inserting pins in cylinder holes. Signal duration is adjustable from 2 to 6 seconds. The multiple-circuit device (No. 1108 four-circuit, 24 hour, illustrated) is enclosed in metal cabinet. Edwards No. 1106 Single Circuit Program Instrument for smaller installation. Details on application.

AUDIBLE SIGNALS

WHAT YOU SHOULD KNOW ABOUT AUDIBLE SIGNALS

The **character of tone** has more value to attract attention than **volume of sound.** Within a normal room, the unusual character of a chime tone attracts attention without the distracting and annoying characteristics of bells and buzzers. Edwards has earned four Army-Navy E's and four Maritime M's designing and manufacturing audible signals for war use. A lot has been learned about sound, and many old habits have been proved wrong. We no longer recommend 12" bells. They are normally not as loud as 10" — just deeper in tone. If a 6" is not loud enough, go to the 10", because we now know there is little or no difference between 6" and 8". For outside use there should be a signal on each wall of the building (10"). Such practice will always be more satisfactory than trying to cover the countryside with one superloud signal.

CLASSROOM SIGNALS



The distinctive character of chime tones attracts attention without the harsh annoying characteristic of bells and buzzers. Model illustrated is the vibrating type and has pleasant two-note chord and is for flush mounting. Another model (not illustrated) is a chime for surface mounting, which is compact and which has a pleasant two-note melody. Where a buzzer is required, Edwards No. 115 Size 4 is mounted in clock case.

SIGNALS FOR GYMNASIUM, SWIMMING POOLS, ETC.

The finest signal available for use in gymnasiums, swimming pools, lavatories, vocational workshops or any locations where the noise level dictates a loud signal. This device is the famous underdome type Adaptabel, which has been installed in schools, hospitals, institutions, industry and all other places where a dependable bell was required. Edwards No. 560-10" Bell.

OUTDOOR SIGNALS

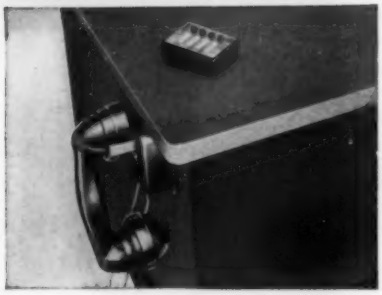
The Edwards No. 1150 10" Bell is best suited for outdoor locations. This bell is similar to the bell developed according to U. S. Navy specifications, which is built to meet the Navy 2000 foot-pound shock test. The volume obtainable from this bell exceeds that obtained by the old-fashioned types. For outdoor locations requiring sound to penetrate conflicting noises and to travel great distances, use the H-2 Horn developed to meet Navy Specifications. This horn is absolutely watertight, insect-proof, and will withstand normal schoolyard abuse. No hood is required.

SCHOOL TELEPHONES AND SCHOOL FIRE ALARM SYSTEMS

FOR CLASSROOMS

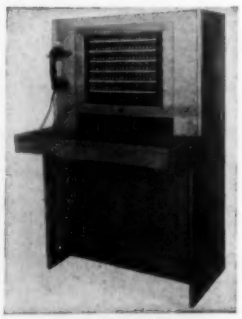
Flush telephone instrument for classroom is attractive, modern and can be painted (on the job) to match wall color. High quality precision instrument. Edwards No. 2130.

FOR PRINCIPAL'S OFFICE



With Edwards Telephone Instrument for principal's office, it is no longer necessary for the principal to leave his desk to ring the desired classroom, then return to his desk. Edwards No. 4653 Cradle Desk Telephone is available with buttons on the instrument. For side of desk mounting, telephone handset No. 4665 with separate push button pad, mounted on top of desk is recommended.

TELEPHONE SWITCHBOARDS FOR LARGER SCHOOLS



Edwards has specialized in the telephone switchboard for schools, institutions, etc. Larger schools require communication between rooms and the interior switchboard is the most satisfactory for this purpose.

SCHOOL FIRE ALARM SYSTEMS

THE Edwards Closed Circuit Coded Fire Alarm Systems (SS for D.C., and SSA for A.C. Operation) are accepted as standard by practically every fire prevention authority in the United States and Canada, and in addition are approved by the Underwriters' Laboratories. Operation of any station sounds that station's code, and shows its location. Each station has its own code mechanism, so failure of one station does not make the system inoperative.

The Control Panel is the nerve center of the system. The number of circuits depends upon the number of signals. The control panel contains relays to supervise the circuits electrically. It is also provided with milliameter, fuses, resistance units and necessary terminals for all wire connections. The panel is enclosed in a steel cabinet suitable for surface or concealed wiring, as specified. A trouble bell is provided which rings constantly in case of an open circuit or other disarrangement until the trouble is removed.

SOUND SYSTEMS AND TEST PANELS

Edwards and Company can supply complete details on Sound Systems and Test Panels on receipt of specifications covering equipment and service required.

INTERNATIONAL BUSINESS MACHINES CORPORATION

WORLD HEADQUARTERS BUILDING

590 Madison Avenue, New York 22, N. Y.

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Administrative Aids

IBM Engineering Laboratory
Endicott, New York

IMPORTANT ADMINISTRATIVE

Call IBM for descriptive literature and technical information on any of the following types of equipment. There are many models of each type, arranged for specific applications.

IBM *Self-Regulating Time Indicating and Signal Systems*

MASTER CLOCKS: The "chief executive" of an accurate and coordinated time system.

PROGRAM CLOCKS: Self - contained units to control any schedule of signals through one or more circuits.

PROGRAM CONTROLS: Arranged to meet schedule and circuit specifications and operate as part of self-regulating time system.

SECONDARY CLOCKS: Visual accurate and uniform time throughout all working areas of any type building. Available in a wide variety of models and sizes for interior and exterior installation. Also built to special design.

TOWER CLOCKS: Motor drive movements operated as part of self-regulating system. All sizes for one, two, three or four dial installations with Westminster and Hour striking bell attachments.

SIGNALS: Bells, buzzers, horns, sirens—all standard sizes and voltages for interior and exterior installation.

ATTENDANCE RECORDERS: Complete range of types to meet every attendance time recording requirement.

JOB RECORDERS: For securing elapsed time on jobs, operations, and processes, a complete range of models to meet every need in distribution of labor costs.

TIME STAMPS: A printed time record on correspondence and documents to establish time of receipt and dispatch, and to place responsibility.

WATCHMAN'S CLOCKS: Provides a record for supervising watchmen by recording time on scheduled routes of inspection.

RECORDOLOCKS: Gives a printed record of when and by what key the door is locked and unlocked.

For Assistance in Preparing Equipment Specifications and Layouts, or to Obtain

AIDS FOR MODERN BUILDINGS

Every building has need for some of these products, whether a one room school, the largest public building, commercial office, industrial plant, radio studio, hospital or airport.

Other IBM *Communicating Systems and Equipment*

CENTRAL CONTROL SOUND EQUIPMENT

Many different models of control cabinets to provide music and speech distribution to one or a group of reproducers. Special features furnished to meet individual system requirements.

A wide selection of reproducers, microphones and accessories.

FIRE ALARM EQUIPMENT

A complete line of electro-mechanical control equipment to provide protection for lives and property.

Stations furnished in flush and surface mounting in all types.

NURSES' CALL SYSTEMS

Patients' call buttons, corridor dome stations, annunciators and pilot light and buzzer stations arranged to meet any requirements.

INTERIOR TELEPHONE SYSTEMS

Control units furnished in common talking type, and also private talking with either switch or automatic dial control, exclusively for private interior systems.

Telephone sets for classrooms, motion picture booths, and cradle type for desk use.

DOCTORS' REPORTING SYSTEMS

Automatic check to determine if doctor called is available. Also a printed record of his arrival and departure time.

LABORATORY PANELS

Voltage distribution experimental panels for use in science laboratories and industrial plant engineering departments.

Descriptive Literature, Contact the Nearest IBM Branch Office Listed on the Following Page

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Mobile . . . . . 1601 Merchants National Bank Bldg.
Montgomery . . . . . 21 Lawrence St.

ARIZONA
Phoenix . . . . . 821 N. Central Ave.

ARKANSAS
Little Rock . . . . 225-227 Louisiana St.

CALIFORNIA
Los Angeles . . . . . 1670 Wilshire Blvd.
Oakland . . . . . 347 13 St.
Sacramento . . . . . 1015 13 St.
San Diego . . . . . 1269 Fourth Ave.
San Francisco . . . . . 25 Battery St.
San Jose . . P.O. Box 879—E. St. John and N. 16 St.

COLORADO
Denver . . . . . 1447 Welton St.

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Bridgeport . . . . . 181 State St.
Hartford . . . . . 100 Farmington Ave.
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INTERNATIONAL BUSINESS MACHINES CORPORATION

THE AMERICAN SCHOOL AND UNIVERSITY—1945

THE STANDARD ELECTRIC TIME COMPANY

Founded 1884

Springfield 2, Mass.

Please Mention This Publication When Writing

PRODUCTS FOR EDUCATIONAL INSTITUTIONS

ELECTRIC CLOCK AND PROGRAM SYSTEMS

FIRE ALARM SYSTEMS
TELEPHONE EQUIPMENT

LABORATORY PANELS
ELECTRIC SHOP EQUIPMENT

BRANCHES

Atlanta
Birmingham
Boston
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Chicago
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Dallas
Denver
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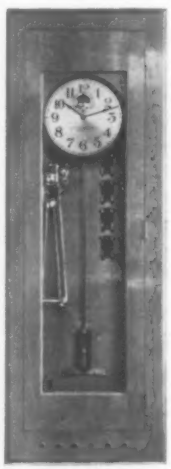
Kansas City
Los Angeles
Minneapolis
Montreal
New Orleans
New York
Philadelphia
Pittsburgh
St. Louis
Salt Lake City
San Francisco
Scranton
Seattle
Tampa
Washington

"STANDARD" ELECTRIC CLOCK AND PROGRAM SYSTEM

This is a centrally controlled system with secondary clocks and program machine synchronized with the master clock on minute impulses. The entire equipment is operated from the 115 AC through 24 V DC dry plate rectifier and is arranged so that all clocks and program machine are automatically reset hourly by the master clock in case of current failure or other irregularities on the minute impulse system. This correction covers a total span of 25 minutes either fast or slow in one hour.

The master clock can be provided with an "accumulator" at additional cost which will compensate for longer periods of current failures up to 12 hours.



"Standard" Master Clocks

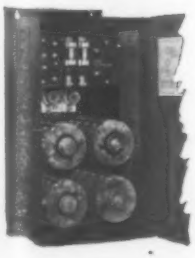
These are regularly made in the 60-beat size with several standard case designs for wall or flush mounting. They are automatically wound and models are made to run 1 hour, 12 hours or 8 days in case of current failures.

Pendulums — Metal ball type regulate within 30 seconds per month, mercurial or invar, 10 seconds per month.

The Program Machine—either the ribbon or metal disk type—may be placed in the master clock case as illustrated, or at an additional cost, in a separate case as shown below.

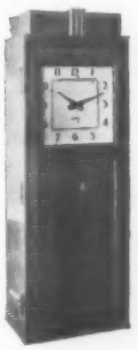
"Standard" Program Machines

These machines are minute interval, furnished in either the tape or disk type, and are built for 2, 4 or 6 program schedules of 12 or 24 hours' duration. They have automatic calendar devices to silence the signal nights, Saturdays, Sundays or any 12-hour period. Push buttons and switches are provided for manual operation when desired. Cases for surface or flush mounting as specified. Cut shows bell board in same case.



Rectifiers

"Standard" Rectifiers are of the stable voltage copper oxide type, and made in sizes from 2 amperes up for the specific jobs they are called on to perform. The standard voltage for clock systems is 24. Rectifiers with proper filter are made for operating the telephone equipment.



Synchronous Motor Master-Program Clock

This is an efficient moderately priced program clock and ideal for small schools where a limited amount of money is available. It has a 2 or 4 program schedule machine of the tape type, run by a 115 V AC 60 cycle synchronous motor from the lighting current (regulated frequency). The program machine and the 12″ dial hands are directly geared together thus making it impossible for the clock and program to get out of step with each other.

The unit has a small red tell-tale signal which appears in case of current failure, and the clock can be reset to correct time by means of a knurled knob in back.

This unit is provided with a 12 V rectifier to operate the signal relays and also up to 6-12″ dial impulse secondary clocks. It does not have any automatic reset feature as the 60 beat pendulum clocks, but is furnished with a manual step-up switch to advance the secondary clocks to the correct time after a current failure.

Program Signals

Buzzers — Type MA

These buzzers are furnished with plate for mounting on a single gang box or arranged for mounting in the secondary clock case. They are made for 24 V AC or DC also for 115 V AC operation.

Underdome Gongs — Type MAPL

These gongs are made in 3″, 4″, 6″, 8″ and 10″ sizes and provided with plate for mounting on a single gang box. The 6″ size is recommended for corridors, cafeterias, gymnasiums, etc., and the 10″ with a weatherproof housing, for outside use.

SECONDARY CLOCKS

Secondary clocks are of the automatic reset, minute impulse type requiring no oiling (some "Standard" clocks now in satisfactory operation with over 50 years' constant service). We give below only a few styles more commonly used but we make scores of models to fit every condition, including large tower clocks.

Flush Clock

This clock has a very thin aluminum rim case projecting only ¾" from wall, and furnished in a polished or lacquered finish, with satin aluminum dial.

No. FMT-10 10" **No. FMT-14** 14"
No. FMT-12 12" **No. FMT-16** 16"

Square Wood Case

These are for surface mounting and are made of birch or oak with hinged fronts, and finished as directed.

No. S-8 8" **No. S-14** 14"
No. S-10 10" **No. S-16** 16"
No. S-12 12" **No. S-18** 18"

Weatherproof Clock

No. C-S-15

This is the most practical clock for outside use made for flush wall mounting, from 18" to 60". It is thoroughly weatherproofed and provided with heavy plate glass storm front, white vitrolite dial with etched numerals, and the case can be furnished with or without lamps for illumination.

Double Dial Bracket Clock

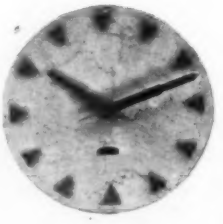
Made for either side wall mounting as illustrated or ceiling mounting. The clock cases are spun aluminum mounted on wood brackets as shown, and all being regularly finished in a medium brown tone lacquer or as directed.

No. 506 12" **No. 508** 16"
No. 507 14" **No. 509** 18"

Skeleton Dial Clock

No. 1771

Skeleton dials are made with plain markers as shown, Roman numerals or specially designed markers as desired. They are of bronze and made in sizes from 12" to 60".



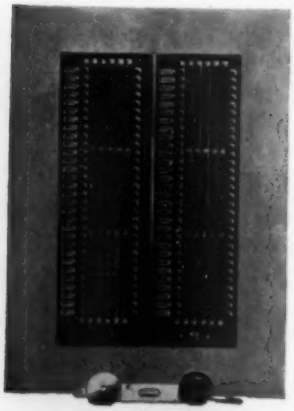
Marble Dial Clock

No. 1770

These clocks are made special of different kinds of marble, numerals, markers, etc., and in sizes from 10" up to 60", all to meet architects' requirements.

"STANDARD" SCHOOL TELEPHONES

The "Standard" telephone system is about the simplest and most efficient for schools. It utilizes the program bell control board as a central telephone station by adding a master telephone instrument, relay, buzzer, switch, etc.



Central Station

A filtered type telephone rectifier is furnished for the talking circuit.

This system is selective ringing and common talking. The buzzers in the class rooms are used as the telephone signals by giving them a couple of short rings from the central station to differentiate between telephone and program.

Any class room can call any other, through the central station only, thus giving complete supervision by the "office" over the entire system. This system has been commonly used in schools throughout the country for 25 years with great success. Due to its simplicity, maintenance cost is practically nil.

Wall Type

Telephone Instruments

These are supplied in different types as required, such as the flush wall, cradle desk type (both as illustrated), surface wall type, hand microphone, etc.

Desk Type

"STANDARD" FIRE ALARM SYSTEMS

Type MC Closed Circuit Fire Alarm System

This is a supervised, closed circuit, master code system, comprising a control panel, No. 451 break glass stations and single stroke gongs or horns. It operates from 24 V battery or 115 V AC or DC.

When a station glass is broken the signals sound a code of 2-3 for 4 rounds, then stop and an emergency bell on panel rings until the station has been restored to normal. In case of an open circuit in the system the emergency bell rings. A switch and pilot lamp are provided to silence the emergency bell until trouble is corrected.

Wiring—All stations in multiple on one continuous circuit with 2 wires brought back to panel from farthest station. All signals in series with up to 10 on a circuit for 115 V and up to 5 for 24 V.

Cabinet—Steel, for surface or flush mounting, 18″ wide, 22″ high, 7½″ deep.

No. 451 Break Glass Station

Fire Alarm Signals

Gong 8″ and 10″

Horn

Fire Alarm Signals are usually 8″ or 10″ under dome single stroke gongs or single projector type vibrating horns as shown above; double projector type horns, however, are furnished when required.

Type BC Closed Circuit, Coded Box System

This is a supervised system using control panel, coded boxes, gongs or horns and operating from 24 V battery or 115 V AC or DC.

No. B.C. 355H Box

Fire Boxes are made in the open door type (BC-150) or break glass, open door type (BC-355H) for surface or semi-flush mounting. They have special keys for drill and test purposes.

When a station is operated 4 station code rounds are sounded on the signals, then the emergency bell on panel rings until silenced by switch with pilot light until station is restored to normal.

Wiring—All stations in series on one 2-wire circuit. All signals in series with up to 10 on a circuit for 115 V and up to 5 for 24 V.

Type 450 Open Circuit Master Code System

This is similar to the MC closed circuit except without electrical supervision. It is simple yet reliable and used successfully in thousands of schools. The system comprises a No. 450 master code box, No. 451 break glass stations (wired in multiple) and single stroke or vibrating gongs or horns (wired in multiple). It operates from 24 V DC or 115 V AC or DC.

Type NC-OC Non-Code General Alarm System

This employs non-code stations (No. 451) with non-contact AC vibrating bells or horns. When station is operated signals ring continuously. Can be furnished with electrical supervision if desired.

"STANDARD" LABORATORY AND ELECTRIC SHOP EQUIPMENT

The uses for this equipment may be generally classified as follows:

A—High, Vocational, Trade and Technical Schools
- Physics and Chemistry Laboratories
- Electric Shops

B—Colleges and Universities
- Physics
- Chemistry
- Chemical Engineering
- Physiology
- Pharmacology
- Biology
- Psychology
- Research
- Electrical Engineering
- Shops

In general this equipment is for furnishing and distributing different voltages, AC and DC, and other electrical services to students' and instructors' tables, lecture rooms, etc., as required for operation of electrical equipment, and also for teaching electricity in its various phases.

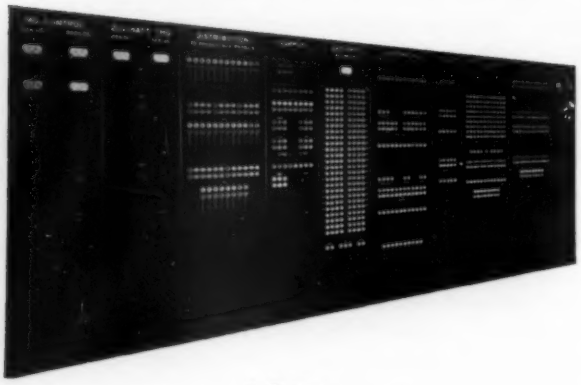
Some of the items designed, manufactured and furnished by this company are listed below:

- Main Control Board
- Distribution Panels
- Bench and Wall Service Units
- Special Test Panels
- Demonstration Type Transformers
- Precision Timers
- Impulse Machines
- Motor Generators of Various Types
- MG Control Panels
- Storage Batteries
- Battery Charging Equipment
- And many other items

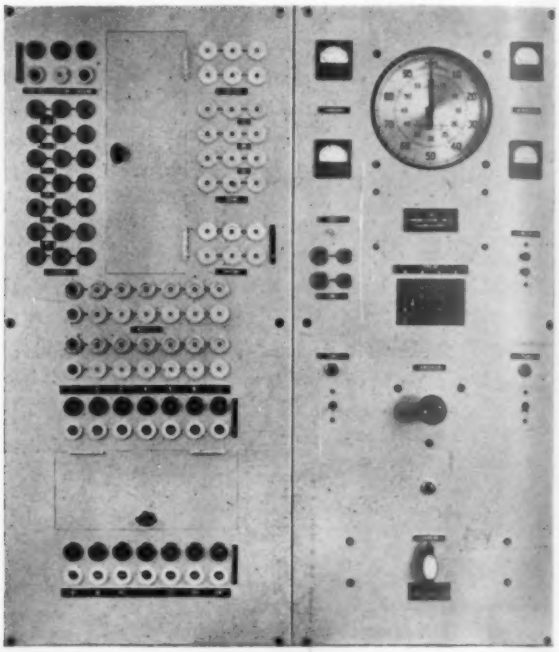
The requirements of laboratories and electric shops needing this type of equipment are special and differ widely with each job, due chiefly to the courses taught, size of classes, physical layout of building, individual ideas of instructors, etc. For this reason this company has a force of field engineers, well trained through many years' experience in this particular line, who are ready to assist architects, engineers and other interested parties, in recommending equipment and layouts to meet individual needs.

This service is rendered cheerfully without any obligation whatsoever so please call on us for it, whether the job is a small or large one.

A Few Examples of "STANDARD" LABORATORY AND ELECTRIC SHOP EQUIPMENT

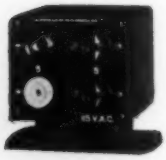


A Large
Main Control and Distribution
Board for a College Physics and Chemistry Building



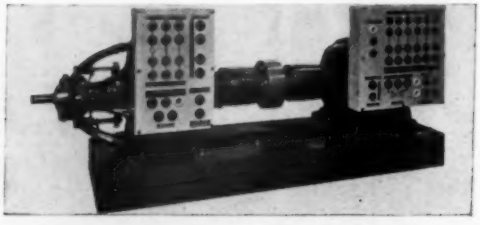
Control and Distribution Board for Physics and Chemistry Laboratory in High School

Electric Shop Switchboard for a Large High School

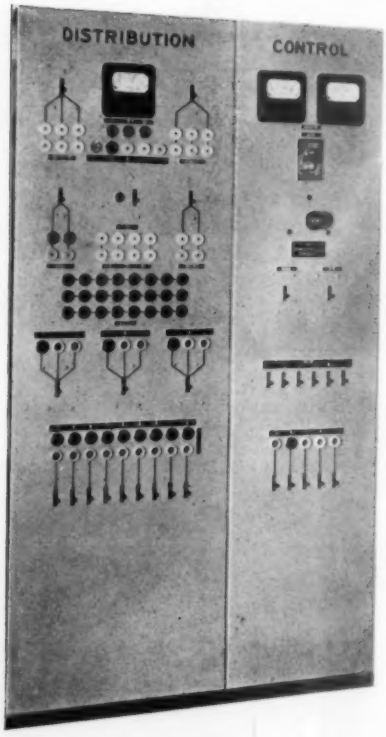


Service Unit for
Bench Mounting

Service Unit for Flush
Mounting in Bench or Wall



A Typical Electrical Shop Laboratory Type Motor Generator with Terminal Panels, to Give Different Motor and Generator Characteristics



Electric Shop Switchboard for Small High School

BELL SOUND SYSTEMS Inc.

1183 Essex Avenue, Columbus 3, Ohio

Sound Equipment for a "Sound" Education

Intercom., Paging, Amplifying, Recording and Public Address Systems

BELL SOUND pioneering and leadership in modern styling and improved sound equipment circuits . . . has enabled schools, universities, churches and even prisons to do a better job through the use of properly applied sound facilities that do not upset budgets. Bell Sound engineers recommend only practical solutions, employing units designed especially for the purpose. Write us for complete catalog and address of your closest Bell Sound Headquarters.

MODEL 601—ZEPHYR—(Unit shown above)

1—Model 615 Amplifier Unit, 15-watt (less tubes)
1—3½ watt Call-Reply Amplifier (less tubes)
1—Superheterodyne Radio (less tubes)
1—Electric Phono Turntable and Pickup
1—Headphone Monitor Input
1—Set of Room Switches
1—Walnut Cabinet

Bell ZEPHYR School System

A beautiful package-unit for a comprehensive all-purpose sound system. High-quality facilities to provide all the functions that sound alone can perform in the modern school.

RADIO — Superheterodyne receiver with wide frequency coverage. Standard unit with all newest features including magic eye tuning and automatic volume control.

AMPLIFIER — Supplied with 15 or 25 watt standard Bell amplifier, according to coverage required. Has 4 stage resistance coupled circuit of most advanced design.

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To Fit Your Requirements for Two-Way Messages

A BELfone System provides economical internal communication for the modern school. Touch a switch and instantly you are in personal contact with any teacher, officer or supervisor. Depress more switches and have a conference without disrupting school routine. What a saving in time and energy! Handling an emergency is just routine when you have a BELfone System. Let us know your problem, we think we've got the answer.

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Voice paging is the quiet, dignified way to reach the person wanted. With Teletalk Paging Systems it is possible to page a person at one station, or at all stations simultaneously. All systems carry volume control, all call and selective call features. Teletalk Speaker-Microphone units are available in models to meet volume required under varying conditions. Location, areas to be covered and noise level are determining factors.

Teletalk Intercommunication

Teletalk Amplified Intercommunication Systems provide natural voice communication between class rooms, departments and buildings. Stations may be called individually or any selected group of stations may be called simultaneously. Total number of stations may be adjusted to meet the requirements of a specific situation.

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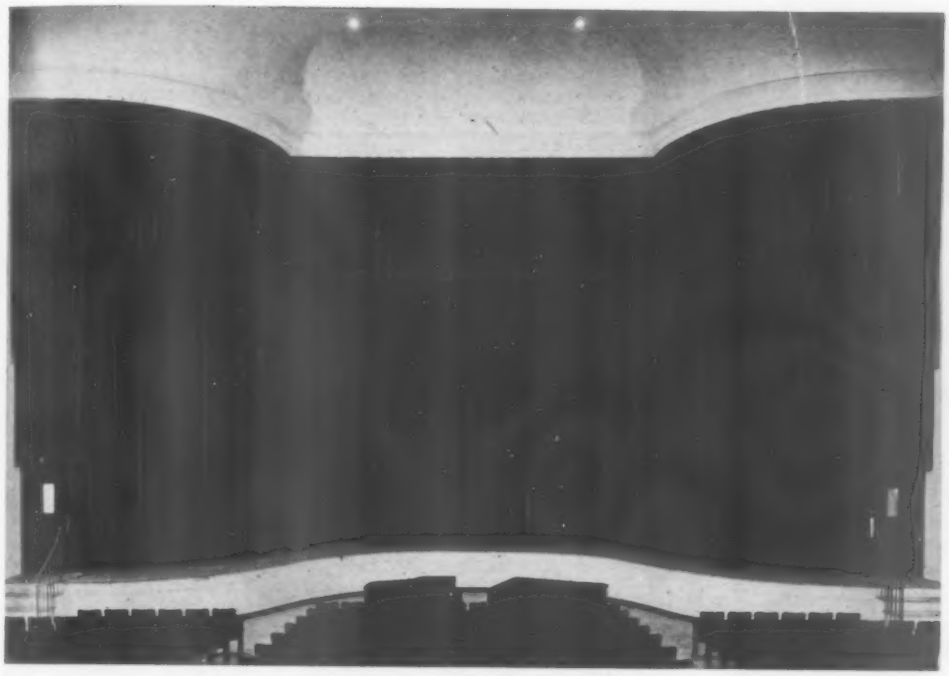

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Center stage proscenium, 21′ high by 32′ wide by 30′ deep. Completely equipped with rope and counter balance rigging.

Two-side stages, size, each, 12′ x 12′ x 21′ high.

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Take advantage of our many years of experience in manufacturing stage equipment.

Our work is thorough, prompt. Our interest in your success is constant. Therefore you will find our services useful and beneficial.

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We maintain a complete rental department.

It is frequently expedient to rent a curtain or back drop for a special scene.

If your school production requires additional drops or cycloramas — velour, satin or painted drops — advise us your requirements.

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3. Depth of stage.
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"Besteel" Medium Duty Curtain Track.
"Steelite" Light Duty Curtain Track.
"Aerial" Type Unit-Combination Track and Machine: ⅓ hp.
"Silver Service" High Speed Curtain Machine: ½ hp.
"Autodrape" Standard Curtain Machine: ⅓ hp.
"Autodrape" Special Curtain Machine: ¼ hp.
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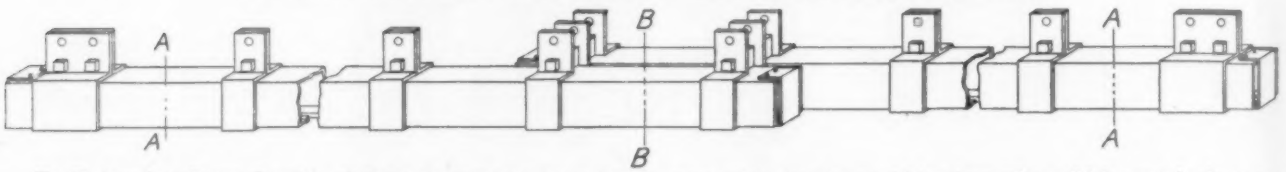
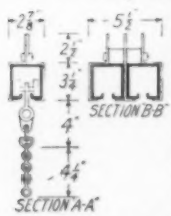


To Determine Gross Length of Track Required—As a basis, start with the clear width of opening which curtain is to uncover; i.e., distance between inside edges of curtain halves when in open position. Add 10% for lap at center for curtain when closed. Add 10% for extension on each end to accommodate each half of curtain when in open position. Total addition is 30%.

Example: Open curtain is to expose 30 ft. clear width. Add total of 30% or 9 ft. for center lap and both end extensions. Specify 39 ft. gross length, in two sections each 19 ft. 6 in.

"SILENT-STEEL" HEAVY DUTY CURTAIN TRACKS

For Any Length—with Curtain of Any Weight



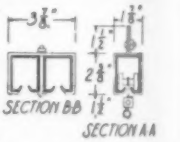
Section Dimensions

Suggested Specifications—Curtain tracks shall be of full-steel construction, 14-gauge, entirely enclosed, except for slot in bottom, each half to be one continuous piece and free of any riveted, welded or other mechanical joints regardless of length, except at center lap. Each curtain carrier shall be supported on ball bearings by two special composition rubber wheels rolling on two separate parallel treads, and all pulley blocks equipped with steel ball bearing wheels adequately guarded; Model No. 280 as manufactured by **Automatic Devices Company** of Allentown, Pa.

"BESTEEL" MEDIUM DUTY CURTAIN TRACKS

For Lengths up to 36 Ft.—with Light or Medium Weight Curtains

Suggested Specifications—Curtain tracks shall be of full-steel construction, 14-gauge, entirely enclosed, except for slot in bottom, each half to be one continuous piece and free of any riveted, welded or other mechanical joints regardless of length, except at center lap. Each curtain carrier shall be of cadmium-plated steel construction supported on self-lubricating bearings by two special composition rubber wheels rolling on two separate parallel treads, and all pulley blocks equipped with steel, ball-bearing wheels adequately guarded; Model No. 170 as manufactured by **Automatic Devices Company** of Allentown, Pa.



Section Dimensions

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"Autodrape" Curtain Machines

All "Autodrape" machines are equipped with exactly the same gear reduction unit, base and automatic reversing switch mechanism, including the following features:

(1) Limit Switch Arrangement — Adjustment for "open" and "close" positions reduced to simplest form.

(2) Elevator Type Traction Drive—Maximum delivered power without slippage.

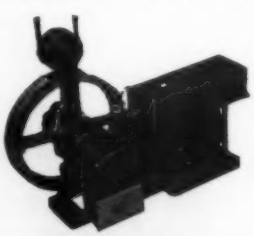
(3) Mounting—Endless cable design allows installation of machine at any position in vertical plane of track.

(4) Disconnecting Clutch—For conversion to hand operation.

(5) Automatic Overload Protective Breaker—Protects machine against excessive loads.

(6) Motor—¼ or ⅓ hp., single phase.

(7) Speed—92 or 115 ft. per minute, equivalent to curtain separation of 2¾ or 3½ ft. per second, respectively (based on 60-cycle current).



"Autodrape" Standard Model

Over-all dimensions: 19½ in. long, 10 in. wide, 15½ in. high

"Autodrape" Special Models—These models have features listed at left and are the lowest priced fully automatic machines on the market; ¼ hp.

Recommended for use with "Silent-Steel" or "Besteel" Tracks up to about 36 ft. gross length.

"Autodrape" Standard Models—In addition to the features listed at left these models include idler system and finger-tip control switch attached to machine; ⅓ hp.

Recommended for use with "Silent-Steel" Curtain Tracks up to about 50 ft. gross length.

"Silver Service" Curtain Machine

This model has all the features of the "Autodrape" Standard Machine. It is equipped with ½-hp. motor delivering a cable speed of 125 or 155 ft. per minute equivalent to curtain separation of 4 or 5 ft. per second.

Recommended for use with "Silent-Steel" tracks up to about 80 ft. gross length.

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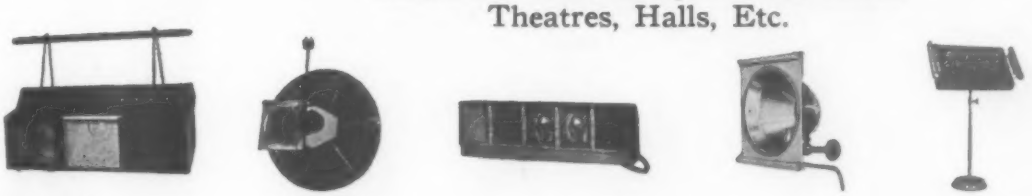

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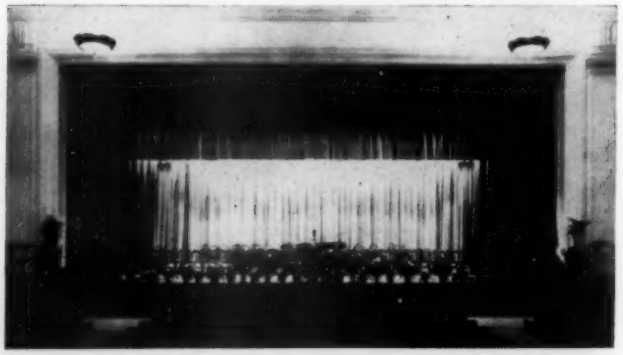

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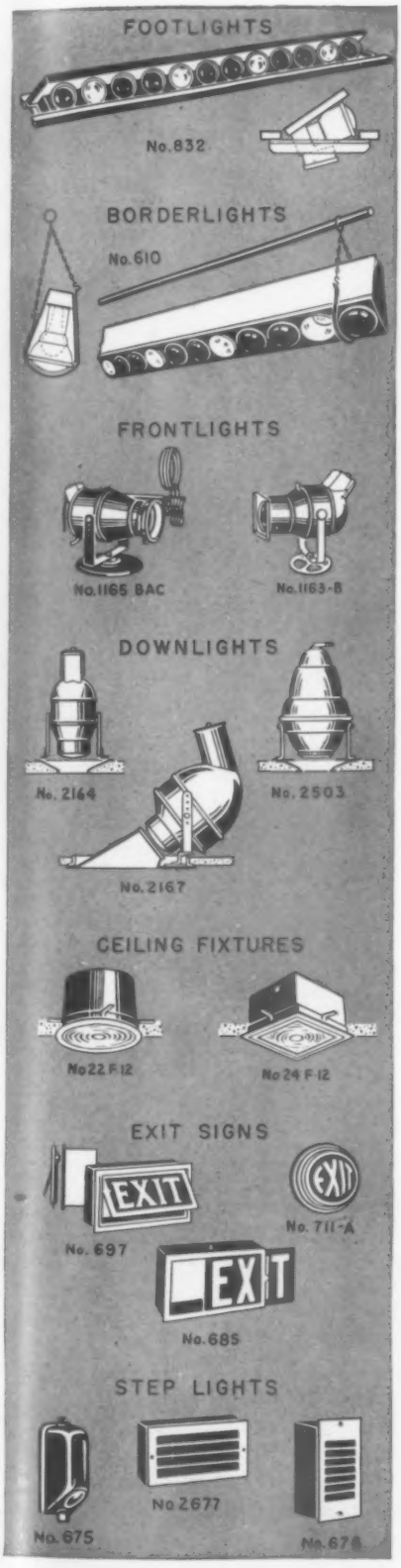

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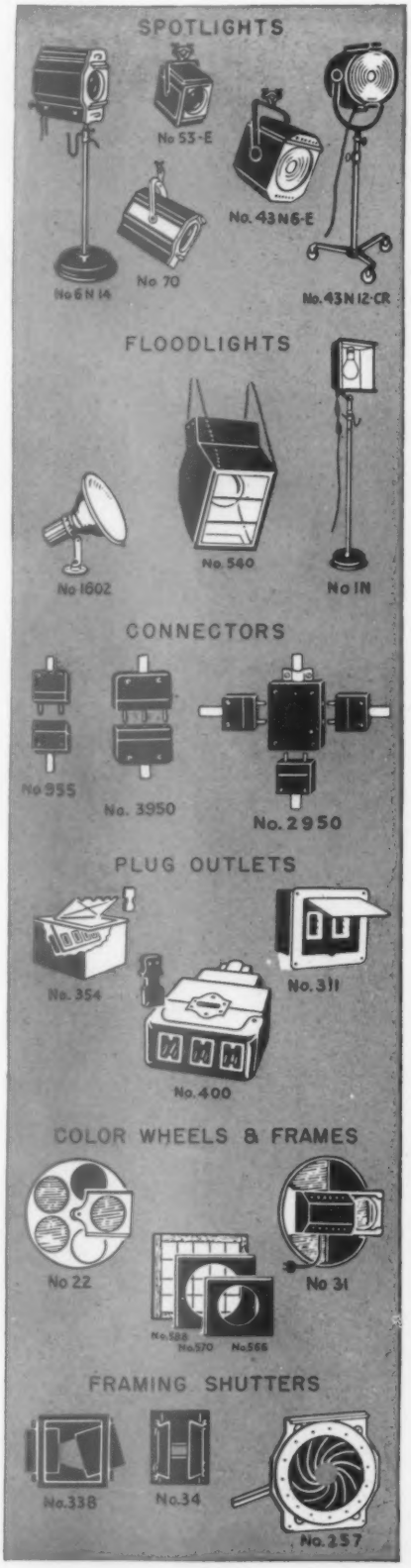

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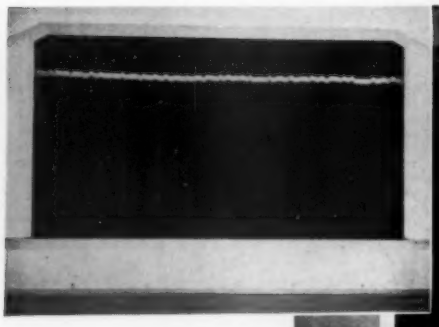

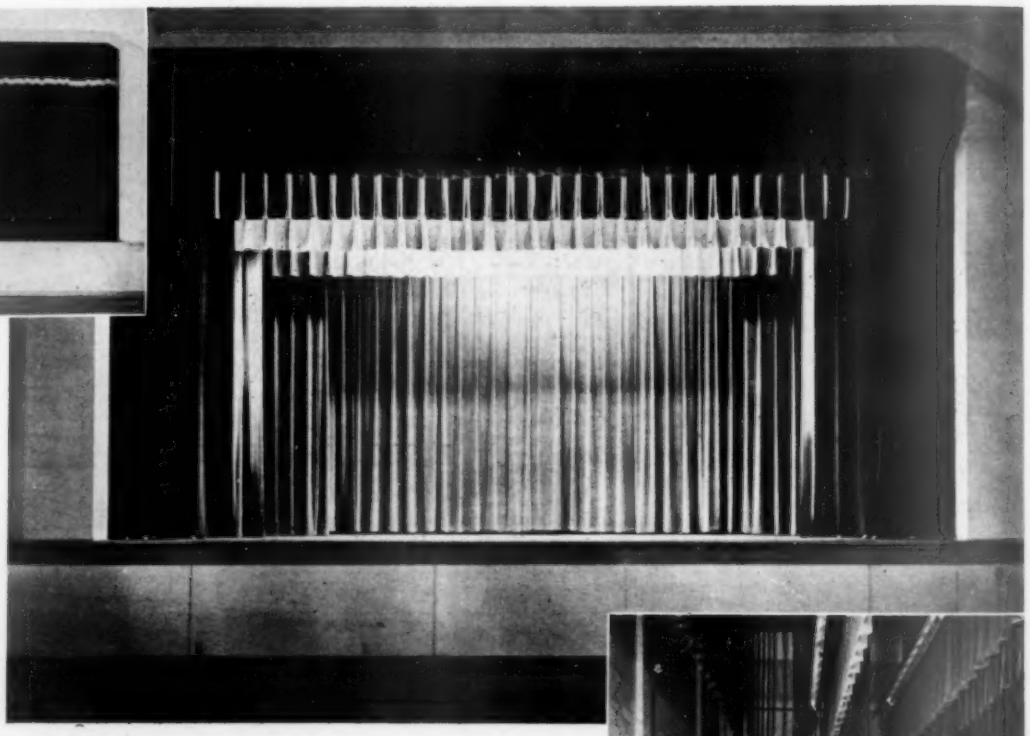

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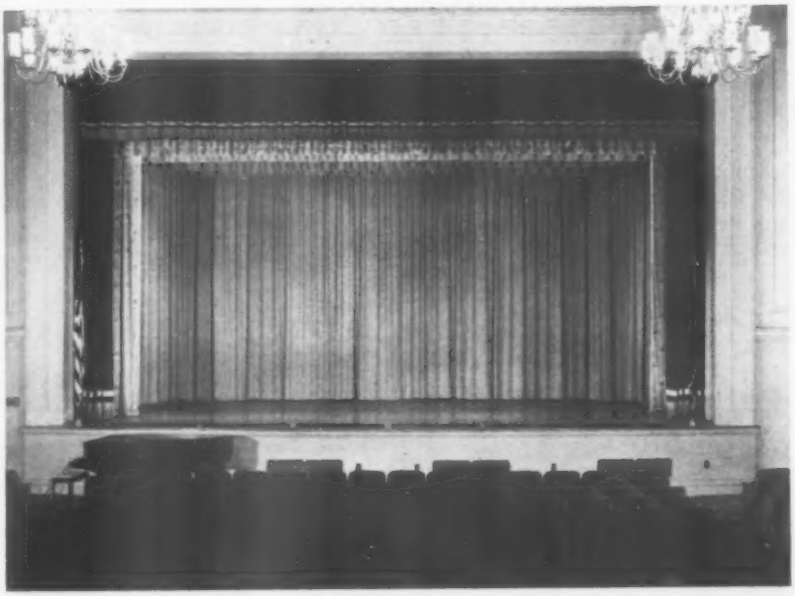

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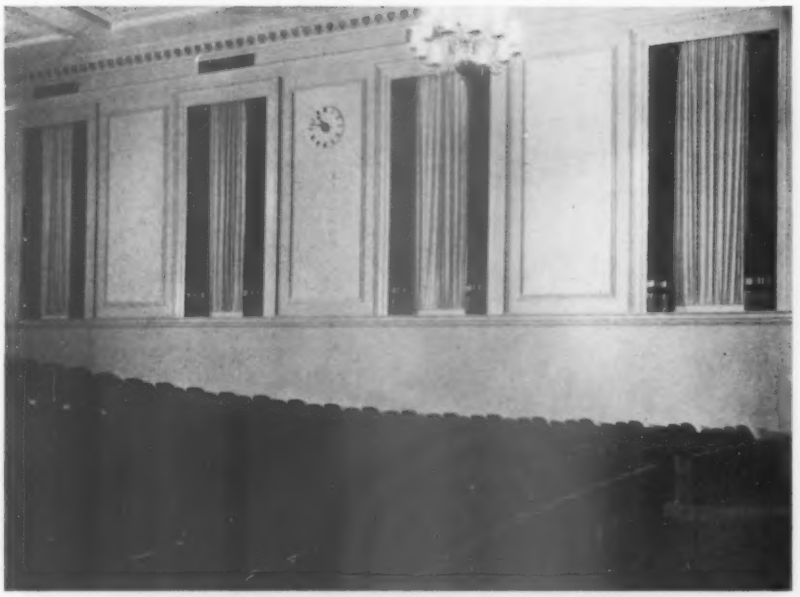

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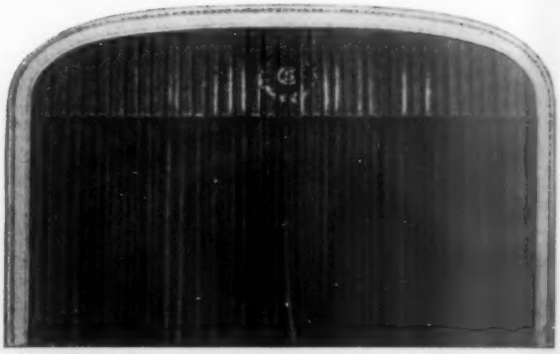

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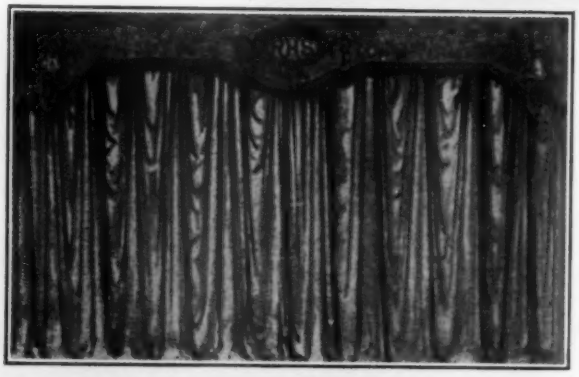

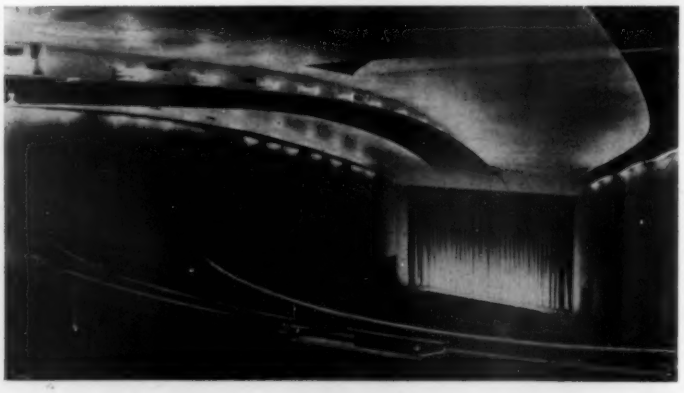

Above—Stage draperies in main auditorium of $2,400,000 theater and art center of the University of Wisconsin

Left—Curtains and draperies in the Virginia State Library and Supreme Court Building, Richmond, Va.

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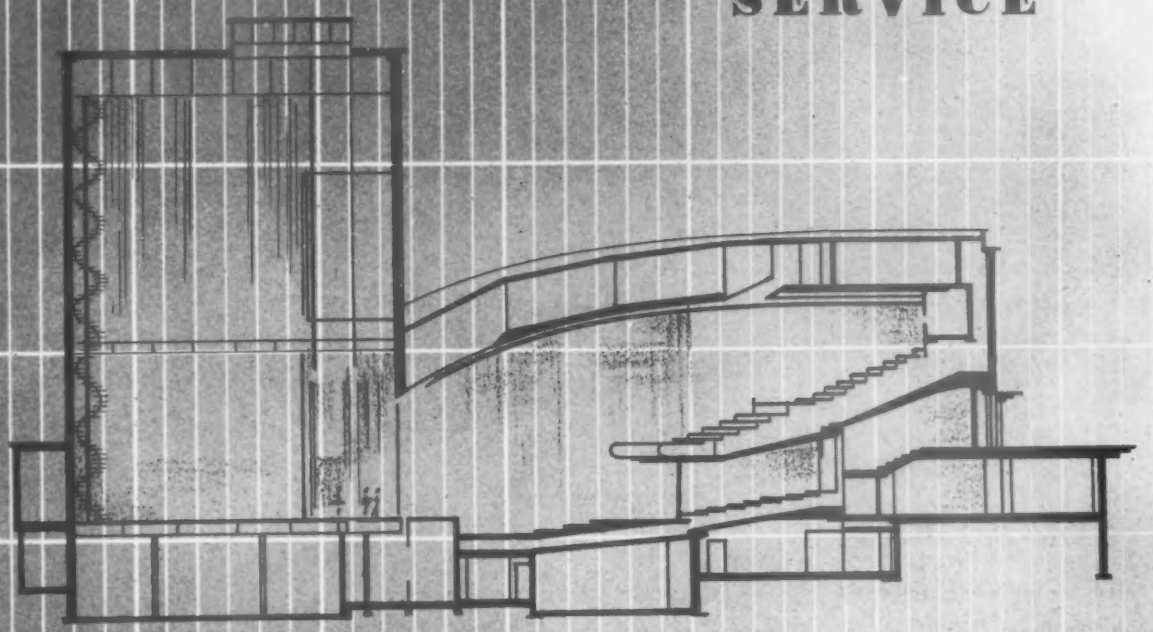

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WRITE FOR DESCRIPTIVE BOOKLET

THE ANSTICE COMPANY, INC.

111 Humboldt St., Rochester 9, N. Y.

STERLING PEELERS

First
Mechanical Vegetable Peeling Machine

★

First
In Peeling Speed

★

First
In Peeling Efficiency

★

First
Streamlined Design

★

First
Choice of Most Schools and Colleges

★ The STERLING line of peelers possesses many additional "firsts" and exclusives, including Hingeless Cover for extra safety; no exposed moving parts—can be operated safely by the most inexperienced person; and, of tremendous importance in many applications, it is the **only** Stainless Steel peeler.

★ Sterling Peelers are manufactured to meet every peeling requirement. The table below indicates the various sizes available and the approximate number of pounds of potatoes which can be peeled per hour.

Size	Floor Space Required	Discharge Height	Lbs. Peeled Per Hour Raw
15 lb.	15" x 15"	All models built to discharge directly into any standard vegetable sink	225 lbs.
30 lb.	18" x 18"		500 lbs.
45 lb.	22½" x 22½"		900 lbs.
60 lb.	" x "		1200 lbs.
70 lb.	" x "		1400 lbs.

NOTE: Approximately one pound of potatoes before being peeled will give two or three servings mashed potatoes.

STERLING DISHWASHERS

Proven
Dependability

★

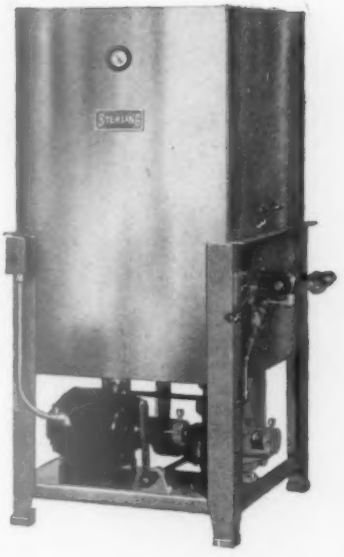
Safe
and Easy Operation

★

High Efficiency

★

Low Operating Cost



★ Many schools, colleges, and other large institutions have ordered and re-ordered STERLING dishwashers many times. STERLING proven **dependability,** direct result of the simple, rugged STERLING design, finest materials, and careful workmanship, is an important reason for these repeat orders. In addition, STERLING'S safe and easy operation, high efficiency (as near germ-free dishes as can be achieved), and low operating costs are also important considerations.

The above illustrated dishwasher is one of the most popular machines used in schools, hospitals, etc.

The following table gives information as to capacities of this and other models—

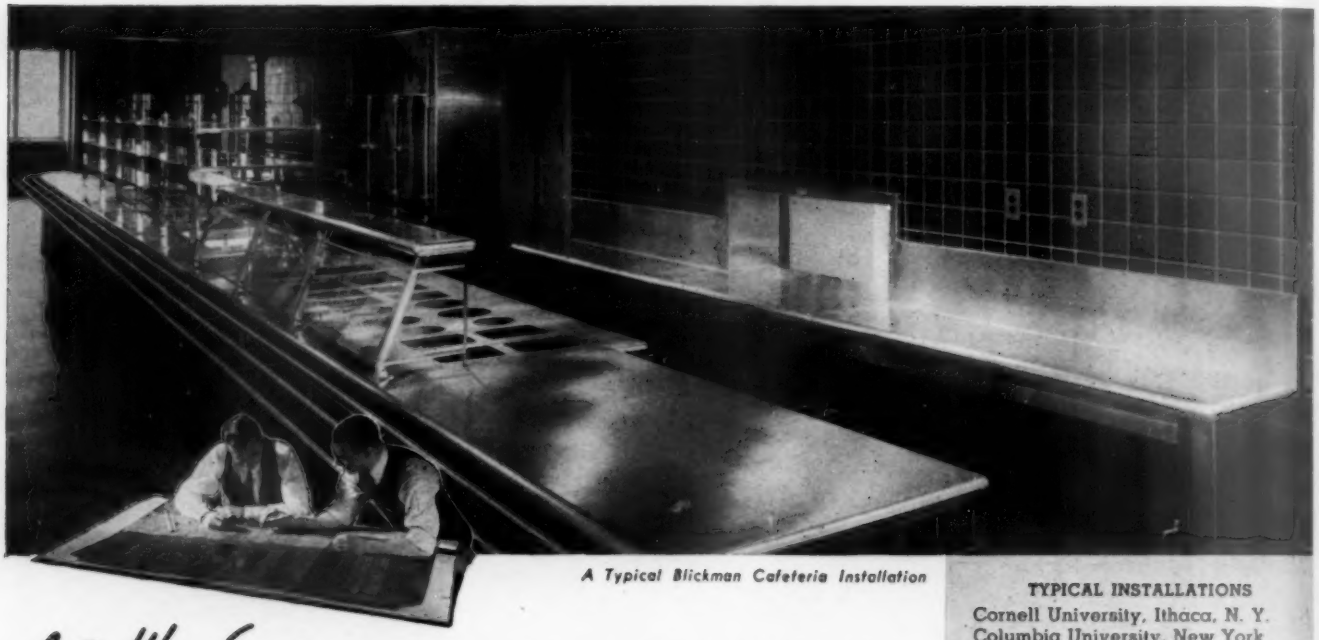
Model	Pieces Per Hour	Meals Average Cafeteria Service
DS-50 1 tank	4,000	500
C-1-A 1 tank	6,500	800
C-2-A 1 tank	9,500	1,100
2-A-60 2 tanks	8,500	1,000
2-A-100 2 tanks	10,000	1,250
2-A-175 2 tanks	15,000	1,500
2-A-250 2 tanks	20,000	2,000

COMPLETE INFORMATION INCLUDING CATALOGS AND SPECIFICATION SHEETS FURNISHED ON REQUEST FOR BOTH PEELERS AND DISHWASHERS; ALSO FOR THE COMPLETE LINES OF STERLING DICERS AND BURNISHERS.

S. BLICKMAN, INC.

Manufacturers of Food Service Equipment for Schools and Institutions

3400 Gregory Ave.
WEEHAWKEN, N. J.



A Typical Blickman Cafeteria Installation

A 3-Way Service FOR MASS FEEDING INSTALLATIONS

1 ENGINEERING and LAYOUT: Our experts are trained to evaluate the specific requirements of a particular establishment and to arrange space and equipment for most efficient operation. On approved contracts, our service includes related planning, manufacture and installation of complete units — from the small pantry or service counter to the large kitchen serving thousands of individuals.

2 DESIGN and FABRICATION of INDIVIDUAL UNITS: BLICKMAN engineers carefully design each item to carry out its function efficiently. Our units are noted for their welded round-corner construction — providing sanitary, crevice-free surfaces. They are easy to clean, durable and attractive in appearance.

3 THE "KNOW-HOW" IN BUILDING FINE FOOD SERVICE EQUIPMENT: For over 50 years, S. BLICKMAN, INC. has specialized in the planning and manufacture of food service installations for every need. Our factory is one of the largest of its kind. Experienced mechanics work with modern tools to give you the finest in food service equipment.

INDIVIDUAL ITEMS OF FOOD PREPARATION AND FOOD SERVICE UNITS Include:

Automatic Electric Hot Food Storage Tables	Dish Heaters	Pantry Cabinets and Cupboards	Storage Bins and Closets
Bain Maries	Dish Tables	Plate Warmers	Tray Trucks
Cabinets	Dish Trucks	Preparation Tables	Utility Trucks
Cafeteria Counters	Dish Warmers	Range Hoods	Urn Stands
Cereal Cookers	Food Conveyors	Service Units	Warmers
Coffee Urns	Food Trucks	Sinks	Water Coolers
Cooks Tables	Kitchen Cabinets	Steam Tables	Work Tables
	Pan and Pot Racks		

Special equipment built to specifications • Orders subject to Government priority regulations

Send for this folder on Food Service Equipment

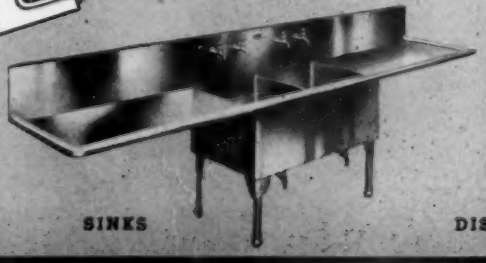
TYPICAL INSTALLATIONS

Cornell University, Ithaca, N. Y.
Columbia University, New York
Syracuse University, Syracuse
Hershey (Pa.) Industrial High School
Bayonne (N. J.) Senior High School
Suffern (N. Y.) Grade School
Washington, D. C. — 15 schools
U. S. Government: Numerous installations for the armed forces.

STEAM TABLES

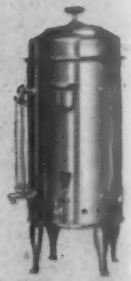
BAKERS' TABLES

WORK TABLES



SINKS

DISH TRUCKS



COFFEE URNS

FROM A SINGLE UNIT TO A COMPLETE INSTALLATION

THE G. S. BLODGETT CO., INC.

53 Maple Street, Burlington, Vermont

NATIONALLY KNOWN

EDUCATIONAL INSTITUTIONS DEPEND ON BLODGETT EQUIPMENT

Quality, variety and volume are assured by the Blodgett Roasting and Baking Ovens that feed the students of some of the nation's best known schools and colleges. Compact and sectionally controlled, they combine economy of space and of operation with minimum wastage.

BAKED GOODS FOR 1200 STUDENTS!

The two No. 982 Blodgett Bake Ovens (above) at Cowie Hall, Cambridge, Mass., Harvard Graduate School of Business Administration, supply all baked goods for 1200 students. Average daily load: 300 doz. rolls, 1200 portions sheetcake, 75 doz. muffins, 1200 baked apples, plus pies, cake, etc.

LUNCHEON FOR 3500 STUDENTS!

Chicago's Englewood High School supplies a meal daily to 3500 students from a kitchen equipped with four Blodgett Ovens. Menus are varied with roasts and baked goods of numerous types. Englewood is one of many Blodgett-equipped Chicago schools.

FOOD PRODUCTION TRAINING

is provided at first-hand by the Blodgett equipment that feeds the 400 students and staff of Brooklyn's Pratt Institute, noted school for dieticians, and at New York's Food Trades Vocational High School, where Blodgett Bake Ovens are used by student bakers and pastry cooks.

Write today for your copies of "Case Histories of Successful Mass Feeding Operations," "The Role of the Roasting Oven in Mass Feeding" and "Meat Cookery in Wartime."

THE G. S. BLODGETT CO., INC.
53 MAPLE STREET, BURLINGTON, VERMONT
BLODGETT —Makers of Fine Ovens Since 1848

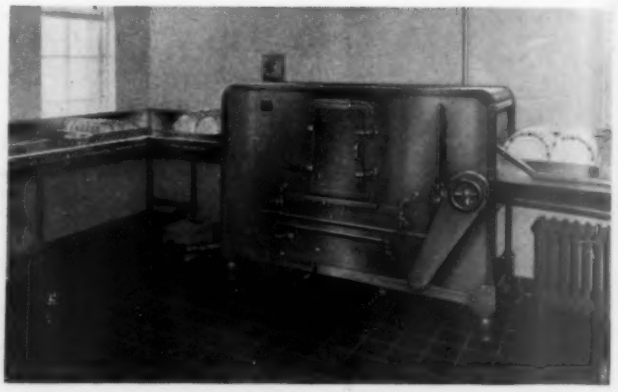
CHAMPION DISH WASHING MACHINE CO.

MAIN OFFICE AND FACTORY
Erie 1, Penna.

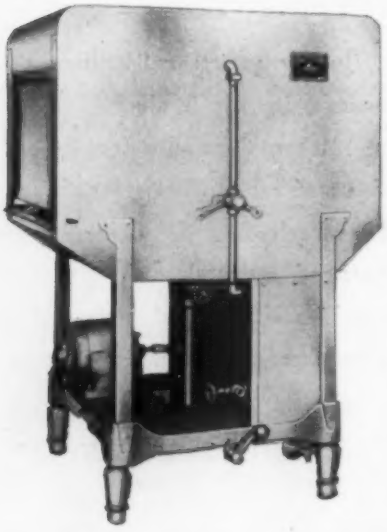
CHAMPION DISH WASHING MACHINES *for* More Thorough Washing *and* Unequalled Dependability

Faster, More Thorough Washing. The Champion's direct forceful sprays combine pressure-plus-volume to give cleaner dishes—faster.

Assurance Against Interruptions. The Champion's clean-cut design and rugged construction have given thousands of institutions Unequalled Dependability in their dishwashing.

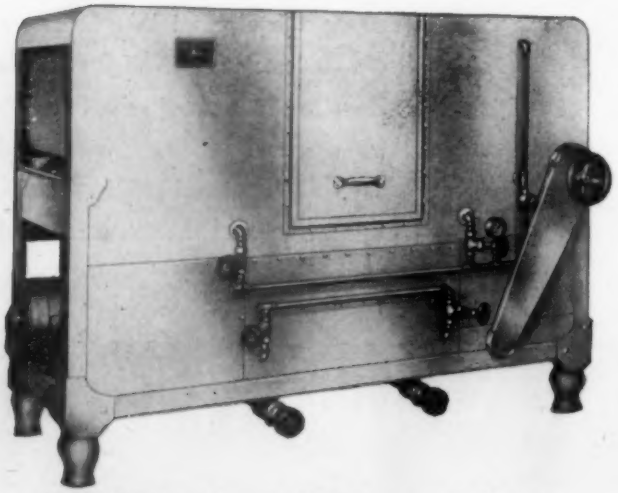


A typical Champion school installation. The complete Champion line includes 18 machines, capacities ranging from 1,500 to 21,000 pieces per hour



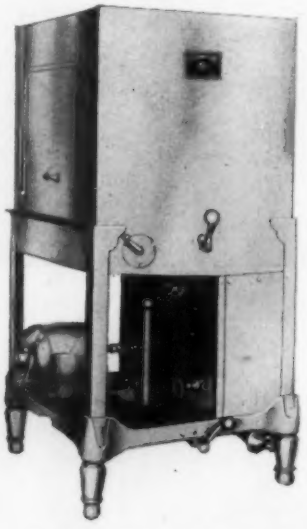
Model 1-S5 Champion. A hand feed machine with curtains; capacity 4,000 pieces per hour

***(At Right)* — Model 1-SD5 Champion.** Capacity 4,000 pieces per hour — similar to the Model 1-S5 but with metal doors instead of curtains



Model 40-E Champion. Double tank, automatic feed. Capacity 11,000 pieces per hour. (Similar models up to 21,000 pieces per hour)

For over 50 years Champion has been noted for machines "Built Like a Battleship," with extra strength at all critical points, insuring more economical operation.



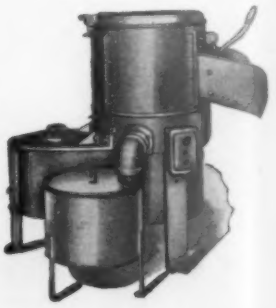
Proved by Results. Champion users give enthusiastic endorsement of the fine results produced by Champions. There are hundreds of schools in the list.

Write us for help, when you are planning improvements. An important part of Champion service is to provide a suitable layout for the space available.

Our experience can help you save time and cut operating costs. Why not use it?

★

Have You Seen the New Champion Peeler? It's an exceptionally efficient machine — the one you want for Fastest Peeling and Easiest Maintenance. Write for description.



THE CLEVELAND RANGE CO.

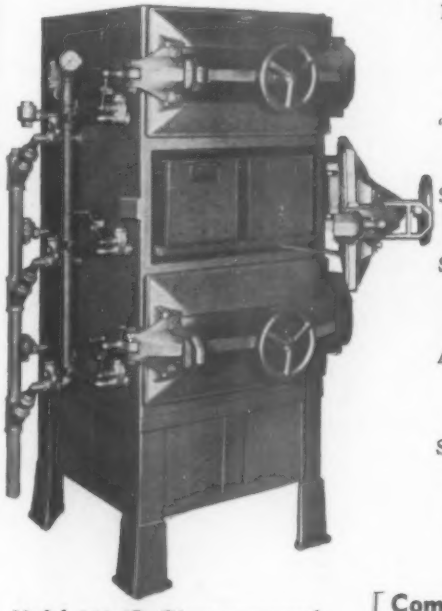
Cleveland, Ohio

STEAM-CHEF STEAM COOKERS

for all School, College and Institution Kitchens. Direct Steam—Gas—Electric Operation

NUMEROUS authoritative tests give ample proof that the steam cooking process results in more nourishing and appetizing vegetables and other foods, because elements providing both vitamins and flavor are more fully retained through this method. Soluble nutrients are better preserved, oxidation of essential food values is reduced. In hundreds of leading educational institutions STEAM-CHEF also saves time, space, work and fuel. It is simple to operate, always ready for use, frees the range top for other purposes, and can be used for a great variety of foods. Many STEAM-CHEF owners use them for canning seasonal fruits and vegetables. There is a STEAM-CHEF model of the correct size and type to fit your exact cafeteria requirements. Some connect directly to a central steam line. Others generate their own steam with gas or electricity. *Steam* is the most economical cooking medium—STEAM-CHEF is the most efficient steamer.

Send for valuable booklet "Getting the Most from Steam Cooking"



Body Construction — One-piece welded bodies of heavy plate steel, rust-proofed or stainless, easy to keep clean and sanitary, insuring low maintenance cost and extra-durability.

"Full Floating" Doors—An exclusive Steam-Chef feature, always seat perfectly, never require adjustments, prolong gasket life.

Safe Operation — Maximum safety results from doors which cannot be opened while steam is being admitted to compartment.

Synchronized Thermostatic Control—Achieves new economy and convenience. Eliminates necessity for steam vent line and cuts steam consumption 50% to 80%.

Automatic Control—of both fuel and boiler water level is provided on gas and electric units—an exclusive feature, effecting fuel saving of 33⅓%.

Sizes and Types—Over 50 models, sizes and types — capacities 2 to 7½ bushels per charge — standard units to fit practically any requirement.

Model 101-3B, Direct-connected typical 3 compartment style. The most popular size for average requirements. Capacity 6 bushels

Complete information and detailed specifications furnished on request. Sold through recognized kitchen equipment dealers everywhere.

Model 2SB, Steam-generating, gas operated, two compartment. Also available in direct-connected type Model 101-2B. Capacity 4 bushels

PROMINENT SCHOOL INSTALLATIONS

Alabama Polytechnic Institute, Auburn, Ala.
Tuskegee Institute, Tuskegee, Ala.
Arizona State Teachers' College, Tempe, Ariz.
Stanford University, Palo Alto, Calif.
Louis Pasteur Jr. High School, Los Angeles, Calif.
Nightingale School, Los Angeles, Calif.
Southern California Military Academy, Long Beach, Calif.
Colorado Springs High School, Colorado Springs, Colo.
Canterbury School, New Milford, Conn.
John B. Stetson University, Deland, Fla.
Georgia School of Technology, Atlanta, Ga.
University of Idaho, Moscow, Idaho
Northwestern University, Evanston, Ill.
Glenwood Manual Training School, Chicago, Ill.
Purdue University, Lafayette, Ind.
University of Indiana, Bloomington, Ind.
Southwestern Louisiana Institute, Lafayette, La.
Wellesley College, Wellesley, Mass.
Groton School, Groton, Mass.
Brooks School, Andover, Mass.
Cranwell Preparatory School, Lenox, Mass.
University of Maine, Orono, Me.
University of Michigan, Ann Arbor, Mich.
Michigan State College, East Lansing, Mich.
University of Minnesota, Minneapolis, Minn.
Stephens College, Columbia, Mo.
University of Nebraska, Lincoln, Neb.
Dartmouth College, Hanover, N. H.
Phillips Exeter Academy, Exeter, N. H.
Princeton University, Princeton, N. J.
University of New Mexico, Albuquerque, N. M.
Cornell University, Ithaca, N. Y.
Fordham University, New York City, N. Y.
Hunter College, New York City, N. Y.
Skidmore College, Saratoga Springs, N. Y.
Syracuse University, Syracuse, N. Y.
Vassar College, Poughkeepsie, N. Y.
Duke University, Durham, N. C.
State Teachers' College, Minot, N. D.
Baldwin-Wallace College, Cleveland, Ohio
Ohio State University, Columbus, Ohio
University of Tulsa, Tulsa, Okla.
Northeast High School, Oklahoma City, Okla.
University of Oregon, Eugene, Ore.
Villanova College, Villanova, Pa.
University of Pennsylvania, Philadelphia, Pa.
Andrew Mellon Jr. High School, Lebanon, Pa.
Bryn Mawr College, Bryn Mawr, Pa.
Allegheney College, Meadville, Pa.
Bucknell University, Lewisburg, Pa.
University of Texas, Austin, Tex.
A. & M. College of Texas, College Station, Tex.
Brigham Young University, Provo, Utah
University of Virginia, Charlottesville, Va.
College of William & Mary, Williamsburg, Va.
Norwich University, Northfield, Vt.
Everett High School, Everett, Wash.
State College, Pullman, Wash.
Auburn Academy, Auburn, Wash.
Davis-Elkins College, Elkins, W. Va.
University of Wisconsin, Madison, Wis.
Lawrence College, Appleton, Wis.
University of Wyoming, Laramie, Wyo.

For BETTER Steaming-
STEAM-CHEF

EDISON GENERAL ELECTRIC APPLIANCE COMPANY, Inc.

5600 West Taylor Street, Chicago 44, Illinois

Branches: BOSTON · NEW YORK CITY · CLEVELAND · ATLANTA · DALLAS · CHICAGO
KANSAS CITY · SALT LAKE CITY · SEATTLE · LOS ANGELES

In Canada:
CANADIAN GENERAL ELECTRIC CO., Ltd.
Toronto

Manufacturers of Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT

In planning or remodeling your school a modern kitchen is just as important as scientifically designed laboratories and classrooms. For greater efficiency, quicker service and the utmost in modern conveniences you need a Hotpoint-Edison All-Electric Kitchen. The ruggedness and dependability of Hotpoint-Edison electric cooking equipment is especially suited to school cafeterias where durability is one of the first requisites. Quality is built into every vital part—heating units, switches, wiring and connections.

Government regulations now permit manufacture of a limited quantity of equipment for essential civilian use. If your present equipment is inadequate or beyond repair, consult your local Hotpoint-Edison distributor today or write to us.

AUTOMATIC ELECTRIC OVEN

Two separate compartments—one for baking, one for roasting — each with independent temperature control. Model N-227 (illustrated) 70 in. high, 54⅜ in. wide, 36 in. deep, leg height, 23 in. Capacity baking section, two roll pans; roasting section, 125 lbs. meat. Connected loads, baking oven; 4.2 KW, roasting oven 5 KW. Total 9.2 KW.

"BRAWNY LAD" ELECTRIC RANGE

Select combination of surface units to fit your needs. Hi-Speed Calrod units. Automatic Griddles, Hotplates. Large, all-purpose oven. R-200 (illustrated) 32 in. high, 30 in. wide, 23 in. deep. Connected load 12 KW.

"CUSTOM TOP" ELECTRIC RANGE

Select combination of surface units to fit your needs...Hi-Speed Calrod, cast-in round units, two sizes of Automatic Griddles, large cast-in Hotplates. R-171 (illustrated) 32 in. high, 36 in. wide, 38 in. deep. Connected load 21 KW.

DEEP FAT FRY KETTLE

New, improved Model K-46 (illustrated). Simplified sediment removal cup . . . "Heat Manager" temperature control. Fat capacity, 60 lbs., 36 in. high, 24 in. wide, 36 in. deep. Hi-Speed Calrod heating units immersed within fat . . . no heat loss! Connected load 18 KW.

OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

ERSHLER & KRUKIN, INC.

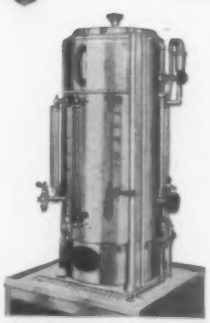
Bayonne, New Jersey

Manufacturers of Kitchen and Cafeteria Equipment for the Economical Preparation and Service of Food and Beverages

THERMOLATOR EQUIPMENT

FOR EVERY FOOD SERVICE NEED

HOT FOOD TABLES



URNS—GAS STEAM AND ELECTRICALLY HEATED

HOT FOOD STORAGE CABINETS

TRAY, DISH AND KITCHEN TRUCKS

Also general purpose, scullery and dish washing sinks; food conveyors; counters; gas electric combination units with food and plate warming sections; hot food storage and refrigeration units.

Cafeteria, Howard Johnson Management, at Casey Jones School of Aeronautics, the largest school of its kind. Equipment designed and installed by Ersbler & Krukin, Inc.

This complete cafeteria and kitchen is one of many food service layouts designed and constructed to meet today's school feeding needs. It is one of many cafeterias designed and installed by us in Princeton, Lehigh, Penn State, and other schools and colleges.

If you are planning postwar construction or remodelling, let our engineers assist you with their specialized knowledge gained from many years of experience.

We can supply individual standardized THERMOLATOR units for every cooking need or handle your complete installation.

Write for full information about our complete School Cafeteria Service

High school cafeteria counter and food service equipment by Ersbler & Krukin, Inc.

Main kitchen; showing equipment designed and constructed by Ersbler & Krukin, Inc.

THE HOBART MANUFACTURING CO.

Makers of Electric Food-preparing and Dishwashing Machines for Commercial and Institutional Kitchens and Bakeries

Troy, Ohio

SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES

HOBART FOOD MACHINES ARE ALSO SOLD THROUGH LEADING KITCHEN OUTFITTERS

HOBART FOOD MACHINES are now available, subject to regulations and approvals as provided.

GUARANTEE AND SERVICE

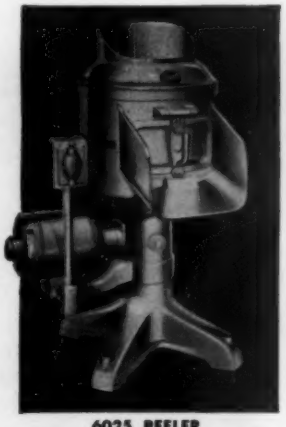
All Hobart Machines are fully guaranteed and serviced by ***one*** nation-wide organization. This avoids uncertainty, confusion, and money-losing delays — and greatly simplifies the purchase and maintenance of all machines used in your kitchen.

Illustrations show representative models only. Each line of Hobart Machines include a range of sizes to fit any application, from the smallest to the largest school kitchen. Full information on all Hobart Kitchen Machines is always available.

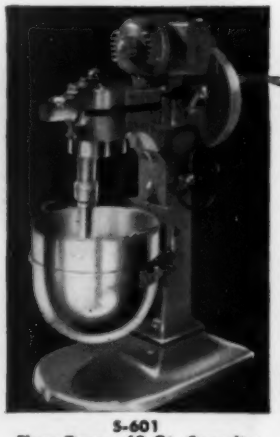
* * *

T-215-GAP FOOD CUTTER
Floor Type 15-Inch Bowl

A-200 MIXER
Bench Type
20-12 Qt. Capacity



6025 PEELER
Floor Type—25 lb. Capacity



S-601
Floor Type—60 Qt. Capacity

M-80
Floor Type—80 Qt. Capacity

Model CM DISHWASHER

Model GM DISHWASHER

Model AM-4 DISHWASHER

WORLD'S LARGEST MANUFACTURERS OF DISHWASHERS, MIXERS, PEELERS, FOOD CUTTERS, SLICERS, CHOPPERS, COFFEE MILLS, SCALES

THE JACKSON DISHWASHER COMPANY

3703 East 93rd Street — Cleveland 5, Ohio

Dishwashing Specialists Since 1925

JACKSON DISHWASHERS WILL DO THE JOB

Efficiently - Easily - Economically

Model No. 1-A is a smaller machine with revolving hood. Ideal for diet kitchens or smaller hospitals and schools

GET Jackson Dishwashers to solve your problems. They are especially designed to meet the needs of schools — where thorough sanitization and high speed efficiency are essential.

Model No. 2. A large machine for high-speed, heavy-duty assignments. With counter-balanced, lifting hood

Engineered to last, Jackson Dishwashers include these exclusive features: *round, one-piece casting body base* with built-in wash and rinse reservoirs; all welded *steel basket* (coated to prevent marking dishes). Leaves no weak spots uncovered. *Double revolving spray arms* force even water pressure to every square inch interior surface. *Interchangeable moving parts.* Replaceable without special tools. *Combination strainer-overflow-drain plug* to collect food particles and prevent flooding or damage through clogging.

Multiple installations in schools cost little — save money and manpower.

WRITE FOR COMPLETE INFORMATION ON ALL JACKSON MODELS

LOWERATOR DIVISION

AMERICAN MACHINE & FOUNDRY CO.

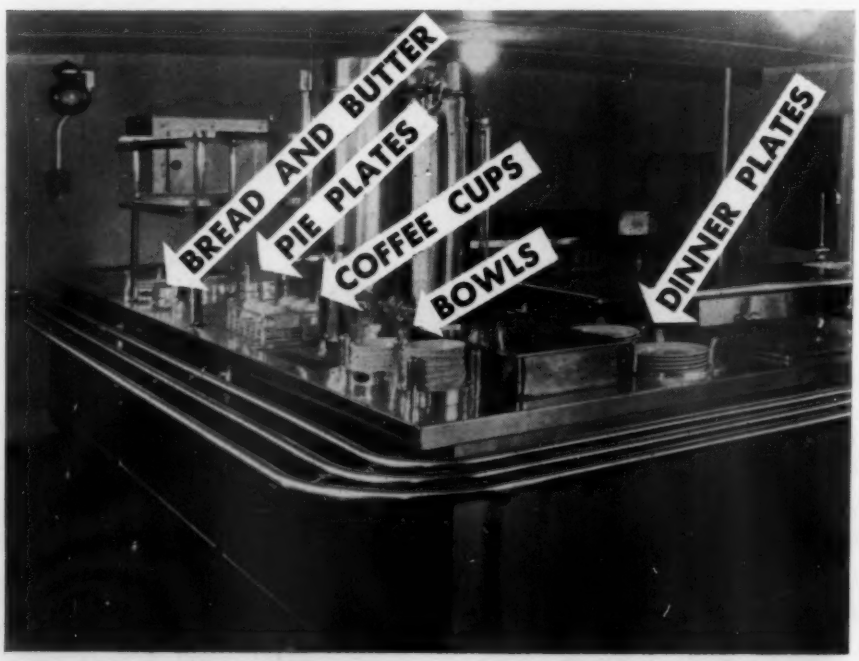
110 Pearl Street Brooklyn 1, N. Y.

Serve more students

in less time this new high-speed way

Cups, saucers, dishes, and bowls right at your counterman's fingertips—secured quickly and easily without stooping or waste motion.

Counter tops kept clear and orderly—service speeded up with less effort, little confusion. All dishes kept from personal contact and breakage. Unnecessary motions are eliminated and efficiency promoted—for amazing amount of storage space is provided in compact area. As each dish or bowl is removed—instantly, silently and automatically, another moves up to replace it. And units can be reloaded any time—unit need not be empty!



Service starts at end of U-shaped counter. Student picks up tray from Lowerator Automatic Tray Dispenser. Following that, he picks up plate, coffee mug, and soup or cereal bowl from Lowerator Automatic Dish Dispensers. Service is speedy and continuous—no lost time or confusion!

Note these exclusive Lowerator System features:

- **Dispenses trays, cups, saucers and dishes automatically at convenient counter height.**
- **Keeps counter tops clear and orderly.**
- **Protects trays and dishes from personal contact and breakage.**
- **Speeds up service—less effort and confusion.**
- **Allows counter attendants more freedom of movement.**
- **Eliminates unnecessary motions—promotes efficiency.**
- **Provides greater storage capacity in less space.**
- **It is a modern necessity and profitable investment.**

★

HIGHLY RECOMMENDED BY LEADING ARCHITECTS

Enthusiastically endorsed and highly recommended by well-known architects and time study experts! Get complete details now on how Lowerator System solves your handling, storage and breakage problems. Write for Catalogue No. 43. It's yours without charge or obligation. Or consult your Kitchen Equipment Dealer.

See Lowerator System on display at Architects Sample Bureau, 101 Park Avenue, New York 17, New York, adjacent to Grand Central Terminal.

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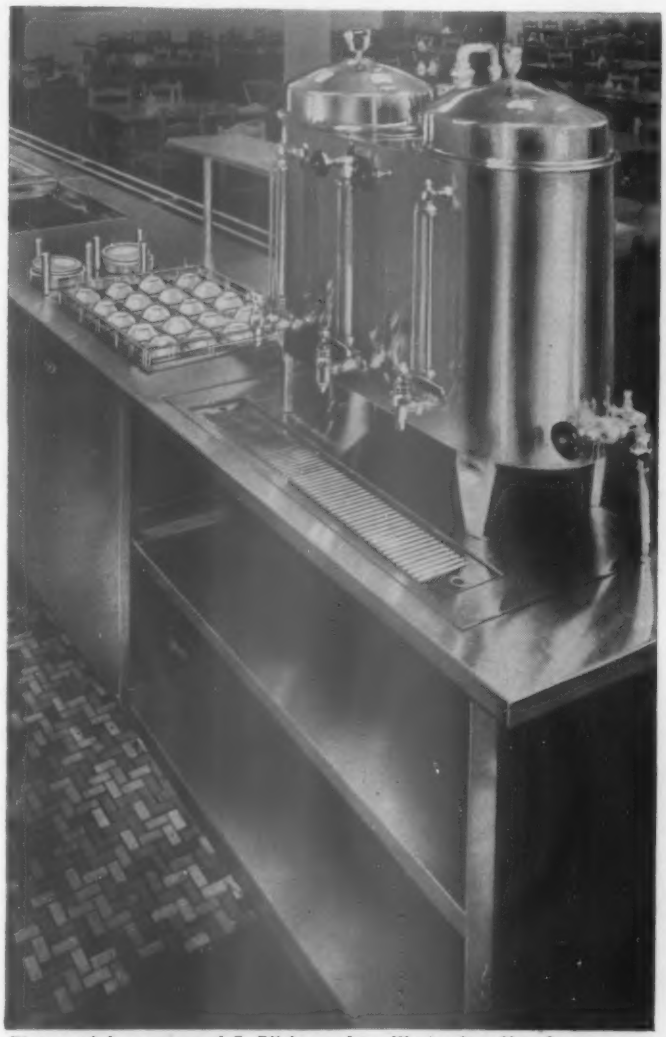


Photograph by courtesy of S. Blickman, Inc., Weehawken, New Jersey.

Here is photographed part of food service equipment, College Commons, Syracuse University, which features time-saving Lowerator Automatic Cup and Saucer Dispenser. Lowerator Automatic Cup and Saucer Dispenser, pictured above, has 160 cup, 200 saucer capacity.

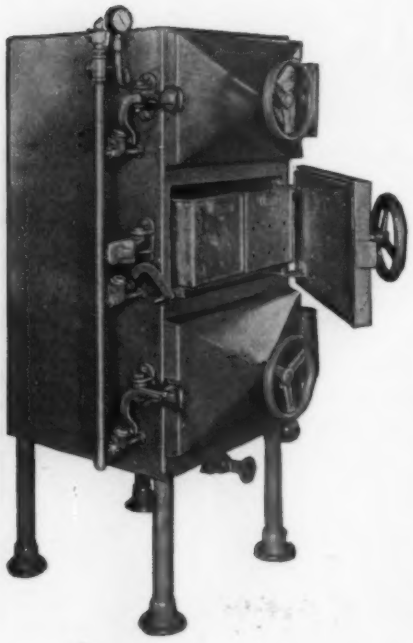
Close up view of Bowl and Dinner Plate Automatic Dispensers illustrated above.

LOWERATOR SYSTEM

Handles Cups, Saucers, Dishes, Glasses, Trays, Bowls, etc.

MARKET FORGE COMPANY

Everett Station
Boston 49, Mass.



Direct-Connected Thermostatically Controlled Steamer — *Model 3M*

GREATER EFFICIENCY, FULL DIETETIC CONTROL, SENSIBLE ECONOMY, APPETIZING FOODS,

for Your School Restaurant,

with MAFORCO COMPARTMENT STEAMER

Maforco low-pressure compartment steamers are proving their efficiency, ease of operation, economy and safety in schools and colleges throughout the country. More flavorful menus—all foods—are better, more easily prepared—with no mingling of taste or odor, because of Maforco compartment arrangement. Maforco is easy to clean, uses less fuel, less time, less floor space. Best quality rust and corrosion resistant materials make Maforco a life-time equipment. Features include: full floating doors with automatic steam shut-off when doors are opened, and automatic sliding shelves beneath baskets. Direct-connected models with standard thermostatic control, or with free-venting, with or without condenser. Steam generating model operates on gas or electricity.

Although proper preparation of food has taken tremendous strides during the last few years, the great majority of people do not yet realize the importance of **steam cooking** in **preserving vital food values.** Calcium, magnesium, phosphorus and iron, Vitamins B and C—all are soluble in water and are therefore readily lost by boiling. Live steam keeps the natural juices sealed within the food. Accepted research has shown that losses through steaming are only one-third of those incurred by boiling.

Flavor also is lost when soluble materials have been **cooked** or **boiled** out of foods. **Steam cooking** retains the natural, characteristic flavors of foods, as well as their proper **texture** and **color.**

Economy: Steam cooking is **less expensive** than previously used methods:—Less fuel is used. Food shrinkage is almost entirely eliminated. Kitchen space is conserved (one three-compartment steamer doing the work of a six-foot range in one-third the space); and, most important of all, there is a definite saving of operating labor. No attention is required during the steam cooking—no danger of boiling over, etc.—It is only necessary to time the brief cooking periods, and these cooking periods are almost unbelievably brief!

Send for free Brochure "Compartment Steamers for Modern Steam Cooking"

FOR COMPLETE DETAILS ON BOTH THESE TYPES, SEE THE BOOKLET "COMPARTMENT STEAMERS FOR MODERN STEAM COOKING," SENT FREE ON REQUEST

RECENT INSTALLATIONS
Schools and Colleges

An Interesting List of
MAFORCO Installations

Yale University
New Haven, Conn.
Harvard University—Cowie Hall
Cambridge, Mass.
Stevens Institute of Technology—Cafeteria
Hoboken, N. J.
Lehigh University—Cafeteria
Hartford, Conn.
Vanderbilt University—Cafeteria
Nashville, Tenn.
Princeton University
Princeton, N. J.
University of Missouri
Columbia, Mo.
University of Pittsburgh—Cafeteria
Pittsburgh, Pa.
Cornell University
Ithaca, N. Y.
Whitman College
Walla Walla, Washington
Washington & Lee University
Lexington, Va.
University of Kansas
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Boston Navy Yard
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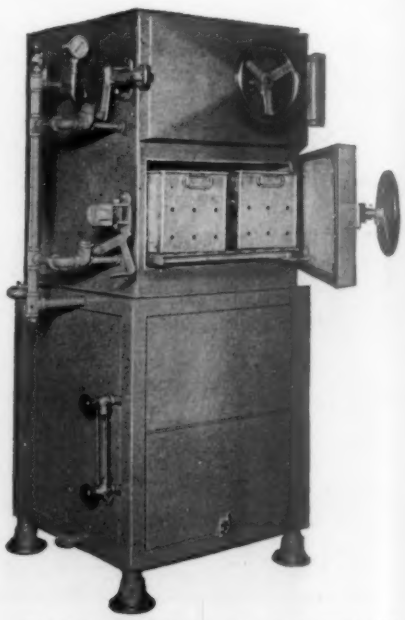


Gas-Operated Steamer — Automatically Controlled — *Model 2M*

MORANDI-PROCTOR CO., INC.

Everett Station

Boston 49, Mass.

LIFETIME KITCHEN EQUIPMENT TO INCREASE THE EFFICIENCY *of Your* SCHOOL RESTAURANT

Complete kitchen and cafeteria installations, including ranges, sinks, traffic rails, tray trucks, cafeteria counters, steam tables, cooks' tables, urns—every type and size of modern outfittings for cleanly, efficient food preparation and service, have long been specialties of Morandi-Proctor Co. Used by outstanding institutions, universities, schools, hospitals, this equipment is master-designed and fabricated, and will give a lifetime of trouble-free service in busy school kitchens and restaurants. You are invited to consult with our engineers to aid in quickly solving any problems relating to food service.

Sink-and-Cabinet Unit

Aisles and Counters in Cafeteria

General Purpose Sinks

Illustration of Complete Food Service Equipment Installation by Morandi-Proctor Co., Inc.

Top efficiency in service is obtained in this Rhode Island high school cafeteria in a small space, serving hundreds daily. Morandi-Proctor Co. engineered design and expert fabrication shown in stainless steel counters, cabinets, guide rails and all service equipment, guaranteeing cleanliness, quicker service, ease of maintenance.

Illustrated on this page are two recent installations, representing the type of engineering and design service for which Morandi-Proctor Co. has long been known; and two types of sinks which indicate a branch of specialized manufacture based on years of experience and leadership. Morandi-Proctor Co. equipment is truly economical, because it gives a lifetime of service, due to the dependable, tested materials, sound design and master workmanship. Morandi-Proctor installations number the leading hotels, schools and institutions of America.

Write to our engineering department for consultation on your specific needs

KEYES FIBRE COMPANY

Manufacturers of Keyes Molded Products
420 Lexington Avenue, New York 17, N. Y.
PLANT AT WATERVILLE, ME.

EVERYTHING YOU WANT IN A TRAY

—here in our latest model

Look at the combination of advantages in KYS-ITE trays—you'll see they're made to order for school and college requirements. Other trays may offer one or two of KYS-ITE's features. But no other type of material can deliver all these KYS-ITE advantages:

Light Yet Strong—Even youngsters find it easy to carry meals on KYS-ITE trays. Yet, if the bus boy piles on the dishes high and heavy—KYS-ITE won't be harmed. Its impact strength is 4 to 5 times that of ordinary plastics—one reason why KYS-ITE is a prime choice where durability is most in demand, such as in pistol grips, valve wheels, etc.

Easy to Clean; Impervious to Boiling—Boiling water may damage some trays. But not KYS-ITE! In actual tests (boiling for 14 days in soap and other solutions) KYS-ITE has not been affected. This quality, plus the easy-to-clean surface, makes possible the highest standards of cleanliness.

Holds Its Good Looks—Visitors at your cafeteria? How do your trays look? A-1 if they're KYS-ITE. That glossy smoothness of finish is highly durable. Colorings are "built in" as an integral part of the material itself. A wipe and it's bright.

Ask your regular wholesaler or supply house about KYS-ITE. Or write us for the names of your nearest distributor—your inquiries are invited.

KEYES
MOLDED PRODUCTS

SINGLE SERVICE TABLEWARE

Think of the time and trouble you could save by not having dishes to wash and wipe! CHI-NET* tableware, made of molded pulp, is sturdy, handsome, sanitary. Yet costs so little you can afford to use once and throw away. Look for CHI-NET when civilian production is again available.

*T. M. Reg. U. S. Pat. Off.

SAVORY
EQUIPMENT, INC.
133 Pacific Street, Newark 5, N. J.

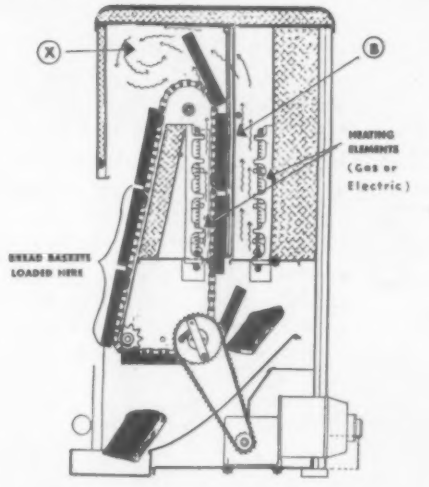
CONVEYOR TYPE TOASTERS

Labor Saving . . . Cost Saving . . . Space Saving

THE TRULY MODERN METHOD OF TOAST PREPARATION

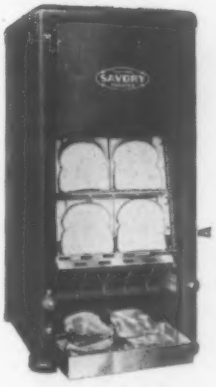
Managers of school cafeterias, college dining halls, and university restaurants and clubs find the high volume of production at peak periods one of the most valuable of Savory Toaster advantages. Students and faculty can get crisp, uniformly browned, *hot* toast as needed. No waiting. No cold, soggy slices. Savory Toasters, depending upon the model, can keep pace with any demand up to 2,200 slices an hour. Adjustable thermostatic controls produce evenly browned slices, light or dark as preferred.

SAVORY TOAST IS BREAD AT ITS BEST



SOLD BY LEADING DEALERS EVERYWHERE

Every Savory Toaster has an exclusive pre-toasting, dome-like oven ("X" above) where moist heat currents keep the center soft and fresh. Slices are then carried down through the toasting chamber ("B") where both sides of the bread are quickly and uniformly crisped by the double heating elements. RESULT — *perfect toast, with soft, tender centers and crisp, crunchy outer surfaces.*



Model CT-2, all-electric, 360 slices per hour

Model PD, gas-operated, 360 slices per hour

Model PQ, gas-operated, 540 to 720 slices per hour

Model CT-4, all-electric, 540 to 720 slices per hour

For prices, detailed specifications, installation and delivery information, call your dealer or write direct.

Savory Toasters are installed in the most modern, efficient establishments everywhere . . . The U.S.M.A., U.S.N.A. Great plant cafeterias like Bendix Aviation's, chains like Woolworth's, hospitals like Walter Reed. Famous hotels like the Waldorf-Astoria. Universities such as Yale.

Low cost and simplicity of installation are features of Savory Toasters. *Operating costs as low as 2 cents per hour.* Also, because Savory is automatic, it requires only part of an attendant's time. Slices are dropped into a rack, ready for service as soon as they are toasted. And even 3-day-old bread can be turned into crisp, delicious, soft-centered toast because of the exclusive Savory pre-toasting oven.

JOHN E. SMITH'S SONS CO.

50 Broadway, Buffalo 3, New York

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

SAVE TIME
AVOID WASTE and REDUCE EXPENSE

in your Kitchen with

Buffalo

KITCHEN MACHINES

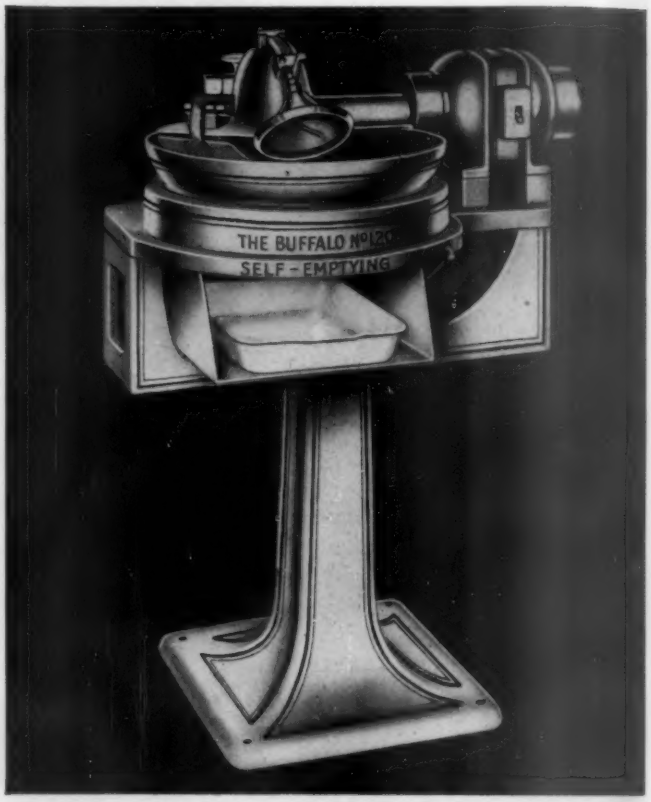
Mechanical units in school and university kitchens must be economical in both initial and maintenance costs and should render many years of efficient service. They must save time, reduce food waste, meet stringent sanitary requirements and prove a definite help in the preparation of healthful and attractive menus.

The Buffalo products shown here are designed to meet... and have met... every condition of economy and utility required by the most rigid school and university specifications.

There are other Buffalo labor-saving machines that meet many modern kitchen needs. They are described in our Catalog. Write for a free copy today.

Attachments for BUFFALO Vegetable Slicers and BUFFALO Food Cutters

Grater—grating cheese, bread crumbs, nuts.
Shredder 5/64" holes—shreds vegetables, etc.
French Fry Cutter.
Julienne Potato Cutter.
Adjustable Slicer—vegetables, nuts, fruits.
Shredder 3/16" holes.
Vegetable Slicer housing furnished as standard equipment including adjustable slicer No. 4.
Meat Chopper No. 12, 200 lb. per hour; No. 22, 400 lb. per hour.
Vegetable Slicer door for slicing vegetables at right angles to knife.
Hub Adaptor—required to connect attachments to Food Cutter.
Knife and Tool Grinder.
Orange Juice Extractor.



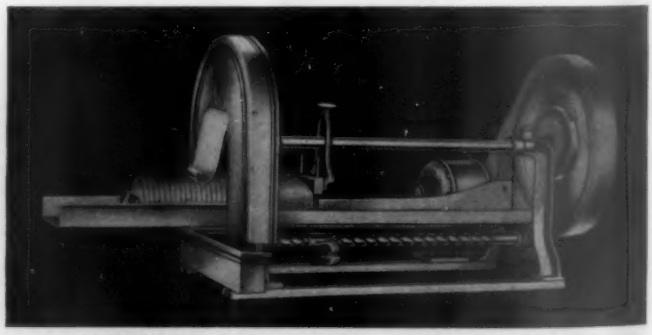
BUFFALO Self-Emptying Meat and Vegetable Cutter Model 120

OTHER MODELS

NO.	BOWL SIZE	CAPACITY
321	21 in.	20-25 lbs.
217-D	17 in.**	15 lbs.
111-D*	15 in.**	10-12 lbs.
114*	14 in.**	7 lbs.

*Also made in bench type without pedestal. **Bowl is removable.

The machine of 100 uses in the kitchen. The only self-emptying model made. For fine chopping of all kinds of meats and vegetables. Its 20" non-removable bowl holds 20 lbs. of fresh meat. Eliminates hands contacting foods. Safe and sanitary.



BUFFALO Bread Slicer (Model 1-A)

OTHER MODELS

NO.	MAXIMUM LOAF SIZE
1½	5¾" x 5" x 23"
2-A	7" square x 26" long

All models either power or hand driven.

Saves time by eliminating hand-slicing. Cuts more slices per loaf, all uniform. Saves from 4 to 6 slices per loaf. Automatically fed, sliced and stacked. Thickness of slice adjustable from ⅛" to ⅜". Model 1-A maximum loaf size 4¼" x 5¼" x 22".

Buffalo

QUALITY KITCHEN MACHINES

STANDARD GAS EQUIPMENT CORPORATION

Bayard and Hamburg Streets, Baltimore 30, Md.

BRANCH OFFICES: New York • Boston • Aurora, Ill. • Chicago • New Orleans • Los Angeles

COOKING EQUIPMENT FOR SCHOOLS

by VULCAN

This is a typical VULCAN installation showing how the individual units illustrated at the right can be used in any combination to fit any school cooking needs. New units may be added as needed.

Improved radial fin top provides faster heating at less cost.

Expando unit gives added top capacity at low cost.

Heat-controlled deep fat fryer saves half frying oil.

Ceramic broiler has more speed, greater capacity.

SINCE 1890, VULCAN has been the leader in the engineering and manufacture of gas cooking equipment for school and university restaurants and cafeterias — equipment which provides faster service, better quality at lower cost — a stream-line, flexible service geared to take care of your requirements today and tomorrow.

Illustrations on this page indicate scope and efficiency of VULCAN service — show how VULCAN units can be combined to provide the kind of cooking service that will best meet the requirements of your institution's cafeteria or restaurant.

Write for our illustrated Catalog — and let us explain how our *VULCAN Planning Service* can help you plan the equipment that will provide the most efficient cooking service for your kitchen.

Roasting oven gives twice oven capacity for same floor area.

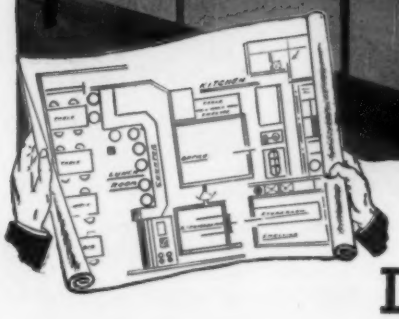
Sectional Oven gives added capacity for both baking and roasting without adding to floor space.

NATHAN STRAUS-DUPARQUET, INC.

Sixth Ave., 18th-19th Sts., New York 11, N. Y.

BOSTON . . . . . Jones, McDuffee & Stratton Corporation
CHICAGO . . . . . Duparquet, Inc.
MIAMI . . . . . Nathan Straus-Duparquet, Inc.

FOR THE SCHOOL OF TOMORROW...



LET'S PLAN TODAY!

War lessons are the basis of tomorrow's planning! We too have been busy learning these past four years . . . gaining experience working for Uncle Sam — helping to convert a large number of America's schools, colleges, and universities into training centers for our Armed Forces.

Our Food Service Engineers have acquired invaluable experience in kitchen and cafeteria design . . . our Decorators and Buyers, busy renovating and equipping class rooms, dormitories and social rooms, have obtained a fuller understanding of school designing problems.

The Nathan Straus-Duparquet Organization, prominent in the pre-war school field . . . now stands ready to give you the full benefit of its "war learned" experience assisting you in planning your School of Tomorrow!

Avoid delaying your post-war planning . . . let's get together NOW!

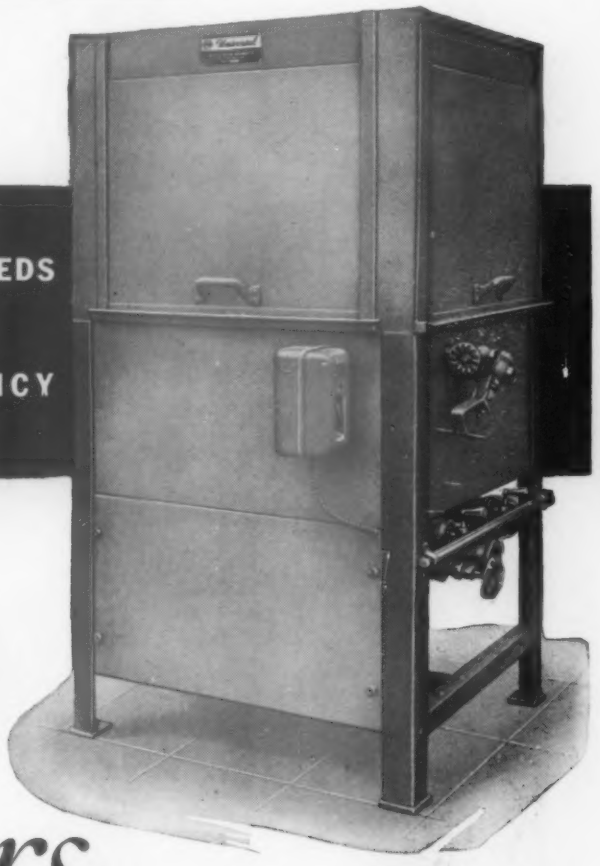
FURNITURE AND FURNISHINGS · DUPARQUET KITCHEN EQUIPMENT
REFRIGERATION · CHINA · GLASS · SILVERWARE · UTENSILS

THE AMERICAN SCHOOL AND UNIVERSITY—1945

UNIVERSAL WASHING MACHINERY CO.

Nutley 10 • New Jersey

MEETS TODAY'S DISH WASHING NEEDS
WITH TOMORROW'S EFFICIENCY



Universal Dish Washers

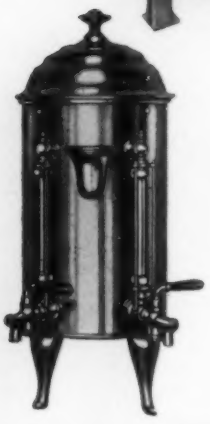
AVAILABLE NOW...FOR ESSENTIAL KITCHENS

MODEL E WASHER
Capacity of 4,000 pieces per hour.
★
PROMPT SHIPMENT
subject to WPB Regulations

Here's the equipment that meets today's demands of high speed, volume dish washing with the smooth efficiency needed in tomorrow's kitchens! Fast! Time and labor-saving! Conserves tableware! Easy to operate! Quickly installed! Military and essential kitchens can get UNIVERSALS now . . . under proper priority ratings. Your kitchen, too, may share UNIVERSAL'S advantages. 15 models. Send for Catalog C.

THE JOHN VAN RANGE CO.

525–555 Culvert Street, Cincinnati, Ohio



COMPARTMENT STEAMERS
STEAM TABLES
FOOD WARMERS
COFFEE URNS
SINKS...TABLES
LUNCH ROOM AND CAFETERIA EQUIPMENT

98 Years of Leadership in

FOOD SERVICE EQUIPMENT FOR SCHOOLS AND COLLEGES

EVER since the year 1847 we have been planning, designing and manufacturing high quality equipment for preparing and serving food in public and private schools and colleges. During the present war all our resources have been devoted to equipping the kitchens of hospitals, colleges, camps and ships of the armed services of the United States and its Allies. Our hands have never lost their specialized skills. We have no post-war reconversion problem.

We are already working on civilian orders that were placed with us months ago in anticipation of the tremendous demands that will come with Victory. We therefore sincerely advise all school administrators to place their orders without delay. Necessary replacement units will be supplied as rapidly as official regulations permit. If you contemplate complete modernization or additions to lunchrooms and cafeterias, make use of our planning service.

Send Us Your Inquiries

The John Van Range Co.
DIVISION OF THE EDWARDS MANUFACTURING CO.
Cincinnati

BRANCHES IN PRINCIPAL CITIES

EDLUND COMPANY

Burlington, Vermont

Address inquiries to O. O. EDLUND, President

Edlund CAN OPENERS

No. 1 HEAVY DUTY AND LIGHTER NO. 2 OPENERS

are for hotels, restaurants, institutions, bakeries, etc., will open No. 10 or gallon cans, and smaller. Individually packed

"Wherever Food is Served"

LEADING EQUIPMENT —

In the Armed Services, on land, on sea, and in the air . . .
In the great majority of all hotels and restaurants across the continent

NOW

Production of Edlund Can Openers will flow increasingly to the civilian trade as rapidly as war-time restrictions can be relaxed. Limited supplies available now.

POST-WAR

The after-war Edlund line will present new applications of advanced design and operation that will be "good news" to all employers of kitchen help.

Available Only Through Supply Houses

EDLUND COMPANY

Burlington, Vermont

Address inquiries to O. O. EDLUND, President

THE FORMICA INSULATION CO.

4614 Spring Grove Avenue, Cincinnati, Ohio

Plastic RESTAURANT AND LIBRARY TABLE TOPS AND DESKS TOPS!

FORMICA provides a plastic finish for many surfaces about the school. It is very desirable because it is sanitary and easy to keep clean; it is very resistant to spotting, staining, cracking or deterioration by ordinary use. There are many handsome colors and finishes.

FORMICA RESTAURANT TOPS

In school restaurants, as in the overwhelming majority of other restaurants, Formica table tops are most widely used. They do not spot with ordinary liquids, do not chip or crack; they are sanitary and easily kept clean. They last for years without maintenance attention.

LIBRARY TABLE TOPS

In libraries and reading rooms Formica tops are finding wide application. They were used in the Annex to the Library of Congress for this purpose and have been installed in many schools and universities. "Realwood" Formica consisting of veneers of genuine wood cured into the plastic sheet—and obtaining thereby all the characteristics of a plastic—are available for this purpose.

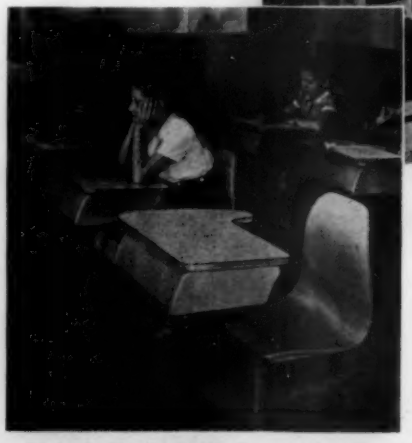
SCHOOL ROOM DESK TOPS

No other finish can provide more attractive tops for study desks than Formica. It resists many forms of abuse that ruin the appearance of ordinary desks. It is easy to clean; stable in color; non-absorbent, not easily cracked or broken.

Formica is used for lobby wall paneling, for counter and table tops, desk tops in business offices and for many other similar uses. Literature with color suggestions and a complete discussion of the characteristics of the material is available on request.

● Formica table tops in a linen finish installed in a vocational school by the Chicago Board of Education.

● Formica table tops in a study room of the Crowe Island School, Winnetka, Ill. Specified by Eliel and Eero Saarinen.



● Desk tops of Formica (linen finish) in a room of the Crowe Island School, Winnetka.

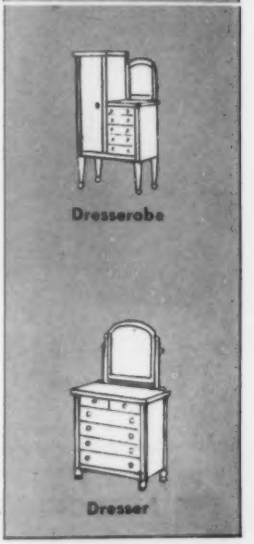
FORMICA

FOR FURNITURE FIXTURES AND BUILDING PURPOSES

DOEHLER METAL FURNITURE CO., INC.

Executive Offices: 192 Lexington Avenue, New York 16, N. Y.

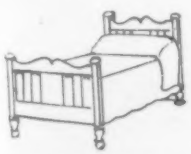
SALES OFFICES: Washington, D. C. · Los Angeles · San Francisco · Portland, Ore.



Picture this DOEHLER FURNITURE *in your school!*

Chest and Armchair

In traditional period design or popular contemporary styles, Doehler has the furniture and equipment you will *prefer*. Our service to many leading schools and universities, our comprehensive experience in the exacting requirements of this field — make us particularly qualified to meet your requirements.



Dormitory Bed

You want comfortable, livable, good-looking furniture; the rigid, non-warp strength of steel; easy-slide drawers. You want furniture with cheerful colors or wood grain effects that won't crack or chip; with burn—bang—heat—and wear-resistant finish. You want all this—Doehler offers it to you.

Desk and Chair

Doehler

Institutional Division

SUPERIOR SLEEPRITE CORPORATION

Contract Department, 2219 South Halsted Street, Chicago 8, Ill.

CT REST EASE MATTRESS (*above left*)—All white layer-cotton-felt, covered with 6 1/5 oz. Government-standard ticking (blue and white woven stripe); heavy and serviceable. Roll edges reinforced with white tape. Matched taped strap handles for easy, frequent turning that promotes long, satisfactory wear.

CT REST HAVEN MATTRESS (*above center*)—White felt, including 25% STAPLE COTTON; built in twin inner units, joined—to hold shape permanently—by center pad of strong, resilient stitched sisal. Features Pre-Built border with multiple embroidered ventilators. White taped-edge reinforcement. Firm, smooth sidewalls assured by 2 rows of concealed side-stitch. 8-oz. ACA cover, button tufted. Matching taped strap handles.

CT REST AIR MATTRESS (*above right*)—Hair content, has double padding of stitched curled hair interlaced on muslin. Cushioned on all-white layer-cotton-felt center. A deluxe, springy construction—for years of splendid service and greatest comfort. Roll edges with fancy taped seams, and with sidewalls kept lastingly trim and strong by 2 rows of hand side-stitching. Heavy, attractive 8-oz. woven stripe cover, extra-button-tufted in biscuit pattern. Matching taped handles.

DOUBLE STUDY DESK No. CT 727—A practical study desk for maximum utility. Center drawers open from both sides. Durable construction resists abuse. Metal top assures smooth, attractive, working surface at all times. Height, 31 in. Top, 30 in. x 48 in.

CHAIR No. CT 4304—Neat, attractive appearance in a durable, well-built chair. Back is made of square steel tubing with flat tube fillers. Front legs are round and tapered. The double H leg reinforcement makes construction sturdy. Glides. Height, overall, 35 in. Seat, front, 16½ in.; depth, 15½ in.

DRESSER No. CT 4401—The functional design and simplicity of the No. CT 4401 Dresser makes it extremely practical for school dormitories and university residences. Sturdily constructed of steel . . . will give years of durable service. Available in beautiful wood-grain finishes. Height, overall, 66½ in. Height of base only, 38½ in. Top, 19 in. x 40 in. Mirror, 23¾ in. x 27½ in.

CHEST No. CT 4401—For greater drawer space, the CT 4401 chest is available in the same graceful design as the dresser above. May be used as matching piece for dresser, or individually. Also available with mirror for individual use. Height, 50 in. Top, 19 in. x 32 in.

SUPERIOR Sleeprite CORPORATION
CHICAGO PITTSBURGH NEW YORK

Skandia FURNITURE CORPORATION
ROCKFORD, ILLINOIS

TO LIVE RIGHT... Sleeprite

SUPERIOR SLEEPRITE CORPORATION

Contract Department, 2219 South Halsted Street, Chicago 8, Ill.

No. 1 COMBINATION TWIN AND BUNK BEDS

Practical bunk arrangement for dormitories where space is limited. Easily converted into twin beds, if desired. Complete with link springs, mattresses, ladder, and guard rail. Wood construction. Available in Walnut or Maple finish. Height (bunk arrangement), 61 in. Height of head (twin arrangement), 36 in. Height of foot (twin arrangement), 27 in. Size 3-0.

Write for descriptions and prices on other types and styles of furniture

ANGLE IRON BUNK BED No. CT 902-LA—Exceptionally effective as inexpensive sleep equipment where space-saving is a factor. Sturdily built of angle iron construction. Equipped with link-fabric springs. Gray enamel finish. Height, 57 in. Size, 30 in.

METAL BED No. CT 658-LE—Attractively designed in simple, graceful lines. This bed is sturdily constructed to give years of satisfactory service. Made from molded tubing, shaped fillers and cross rods. 2 in. casters. Finished in baked-on enamel. Height (including casters), 26 in. Height of fabric, 17 in. Sizes, 3-0 and 3-3.

METAL BED No. CT 653-LE-B—Designed similar to the CT 658 bed, above, except head end is higher and panel in head and foot replaces two of the fillers. Continuous posts, fillers and cross bars of molded tubing. Height of head (including casters), 36 in. Height of foot (including casters), 26 in. Height of fabric, 18 in. Size 3-0.

TO LIVE RIGHT... *Sleeprite*

THONET BROS., INC.

1 Park Avenue, New York 16, N. Y.

1698 Merchandise Mart, Chicago

THONET BENTWOOD FURNITURE

FOR ALL KINDS OF SCHOOL INTERIORS

including classrooms, faculty offices,

libraries, cafeterias and study halls.

Constantly imitated . . . Never equalled

UNIVERSAL EQUIPMENT COMPANY

Furniture for Schools, Colleges and Libraries

General Offices and Plant: Batesville, Indiana

THE CHOICE OF EXPERIENCE FOR OVER 70 YEARS

INCLUDED in the roster of our clients are a great many of America's most distinguished institutions of learning. They have found that our dining room, lounge, library and dormitory furniture has met the "test of time."

Charmingly Furnished Girls' Dining Room

THE outstanding features that have characterized Universal's "Master Made Furniture," are: homelike comfort, harmonious beauty, selected materials and its exclusive Thermo Weld Construction.

INQUIRIES are invited from institutions contemplating the post-war purchase of equipment. Our trained staff of technical experts will extend every assistance in preparing plans and specifications to meet every requirement.

Distinctive Lounge in a State Teacher's College

Ideal Men's College Dining Room

UNIVERSAL

EQUIPMENT COMPANY

FURNITURE FOR SCHOOLS COLLEGES AND LIBRARIES

A DIVISION OF ROMWEBER INDUSTRIES

GENERAL OFFICES AND PLANT, BATESVILLE, INDIANA

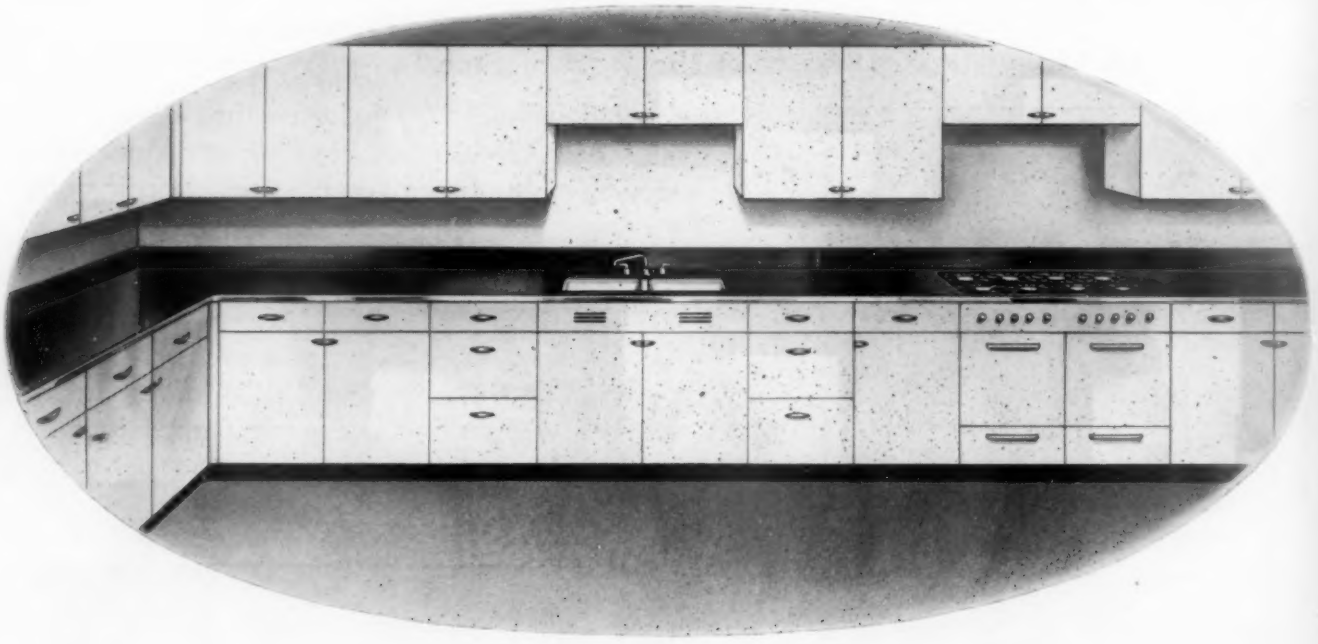
LYON METAL PRODUCTS, INC.

General Offices: 1334 Madison Avenue, Aurora, Illinois

BRANCHES AND DEALERS IN ALL PRINCIPAL CITIES

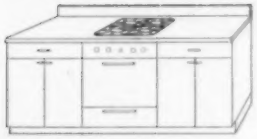
LYON

SECTIONAL KITCHENS FOR SCHOOLS and CAFETERIAS

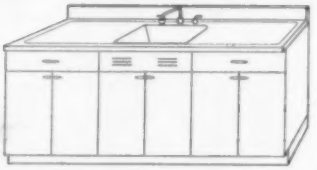


DISTINCTIVE kitchen arrangements for schools and institutional cafeterias are easily made with Lyon steel sectional units. Simplicity and beauty of design, durability of construction and adaptability to any size, shape, and type of kitchen are only a few of the many features making these sectional kitchens outstanding.

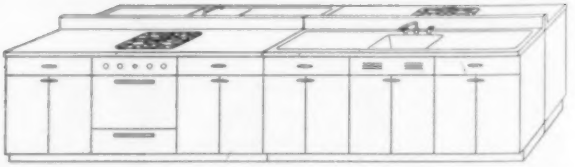
KITCHEN UNITS FOR DOMESTIC SCIENCE CLASSROOMS



The stove unit is designed to accommodate two students without interference. Drawers and working areas placed to the right and left of the four burner stove, allow each student ample room and cooking space. All work tops and stove top areas are stainless steel for cleanliness and durability.



Designed for use with or without the stove unit, this sectional sink has a stainless steel top and plenty of cupboard space. Contains enough sink cabinets to handle necessary utensils for two students.



The above photograph shows one of many multiple arrangements of Lyon stove and sink units. Stoves and sinks are placed back to back and in parallel or series depending on size of room and number of students.
By placing another similar unit directly opposite; a compact, efficient working area accommodating 16 students can be made.

FOR ADDITIONAL INFORMATION, ASK FOR BULLETIN NO. 2000

ELECTRICAL EQUIPMENT FOR THE HOMEMAKING DEPARTMENT

G-E Consumers Institute Laboratory Kitchen

GENERAL ELECTRIC COMPANY
APPLIANCE & MERCHANDISE DEPARTMENT

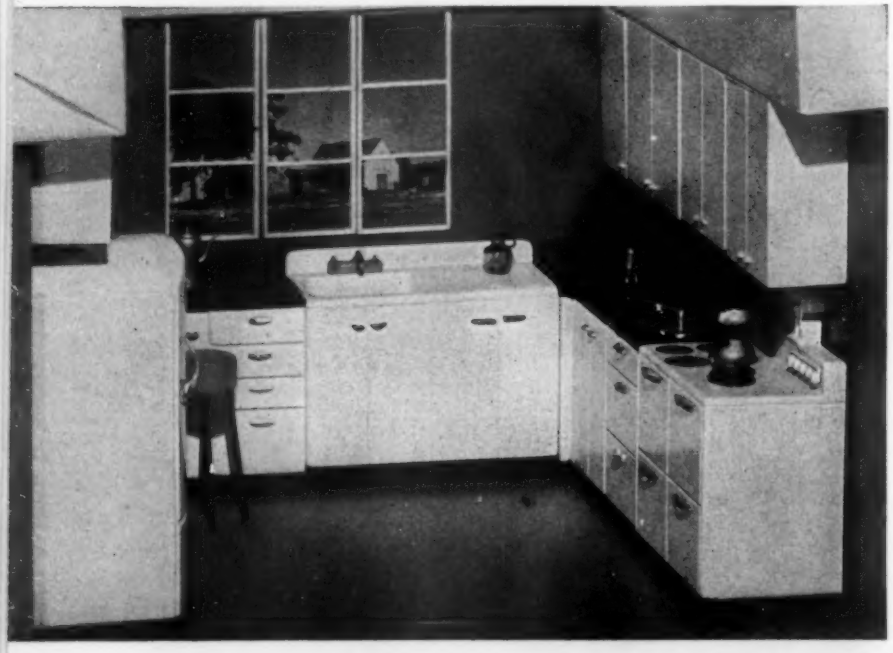
BRIDGEPORT :: :: :: :: CONNECTICUT

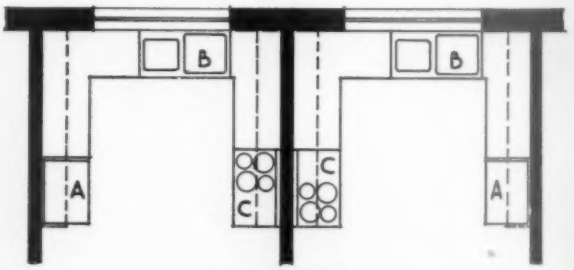
PLANNING AND EQUIPPING THE

During the past decade, tremendous advances have been made in the education of the homemaker to higher standards of efficiency in practically all household duties. Naturally, the Home Economics Departments have played a dominant part in this development.

This evolution has brought about greatly expanded activities in both the scope and character of home economics training courses. Likewise, the future demands continued progressive revision of classroom arrangement, facilities and equipment. Provision must be made for effective teaching methods and routines that will assure not only keeping abreast with current programs, but also for further study of new developments and trends.

While special laboratory-type facilities such as shown on the preceding page may be desirable for technical research studies, the advantages of home-type facilities and equipment are being recognized for more practical training in general home economics classrooms. Arrangements planned to simulate actual home conditions are readily adaptable to effective teaching methods and adequately provide for the many varied and expanded activities of progressive Home Economics training courses. Cottage type facilities are being more widely accepted in present Home Economic programs where complete home training courses are to be made available.

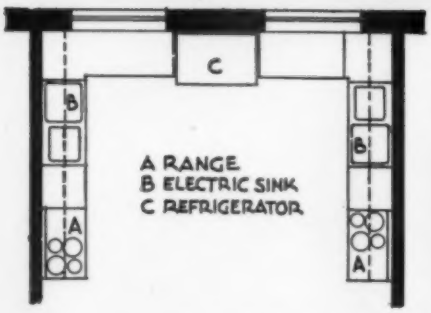




A-REFRIGERATOR
B-ELECTRIC SINK
C-RANGE

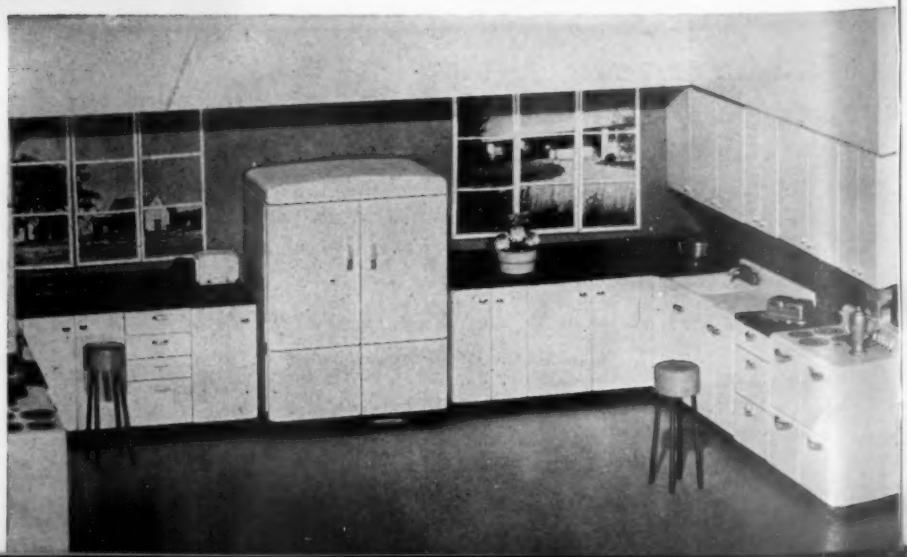
DOUBLE KITCHEN

U shaped kitchens in multiple units provide individual working sectors and homelike atmosphere in a minimum space.



DOUBLE KITCHEN

Facing L-shaped kitchens conserve space while maintaining in effect the entity of a complete home kitchen.

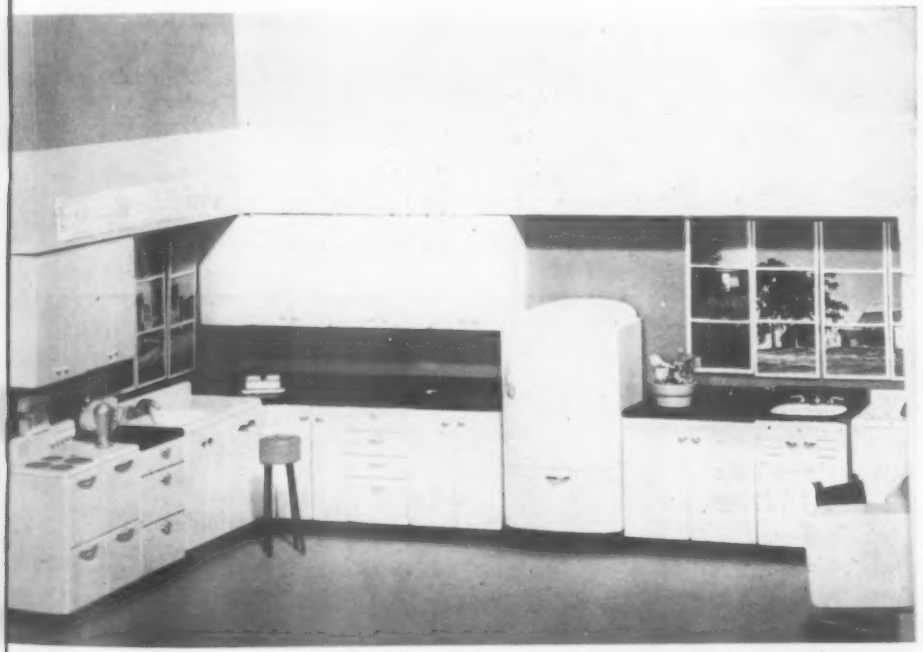


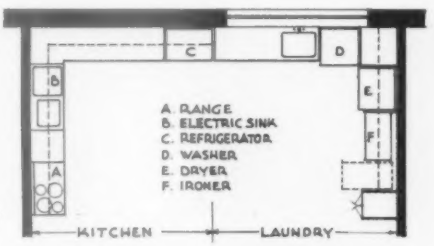
CLASSROOM KITCHEN AND LAUNDRY

The illustrations shown on this and the opposite page are a few of the basic arrangements of kitchen and laundry layouts, and show how home-type facilities and equipment can be adapted to classroom work. These arrangements meet the varied requirements dependent upon the size of the school, the number of enrollments, and the amount of training offered. Within minimum space limitations, facilities and equipment provide complete training in the following type of kitchen and laundry courses:

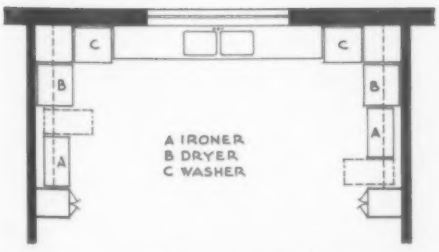
Lay-out planning of facilities.
Decoration and color schemes.
Use and care of equipment.
Food preservation—fresh and frozen food refrigeration
Food preparation and cooking, methods, etc.
Sanitary methods of dishwashing and waste-food disposal.
Storage of foods, dishes and utensils (cabinet equipment, arrangements, etc.).
Study of work surfaces (materials, areas, location, etc.).
Selection and care of clothing.
Removal of stains and repairs.
Modern methods of washing, drying, starching and ironing.
Storage of laundry materials (cabinet equipment, arrangements, etc.).

Before the war General Electric, through its distributors and dealers, maintained complete services for architectural planning related to the selection and layout of equipment and facilities for Home Economic Departments. This type of service will be resumed as soon as conditions permit.





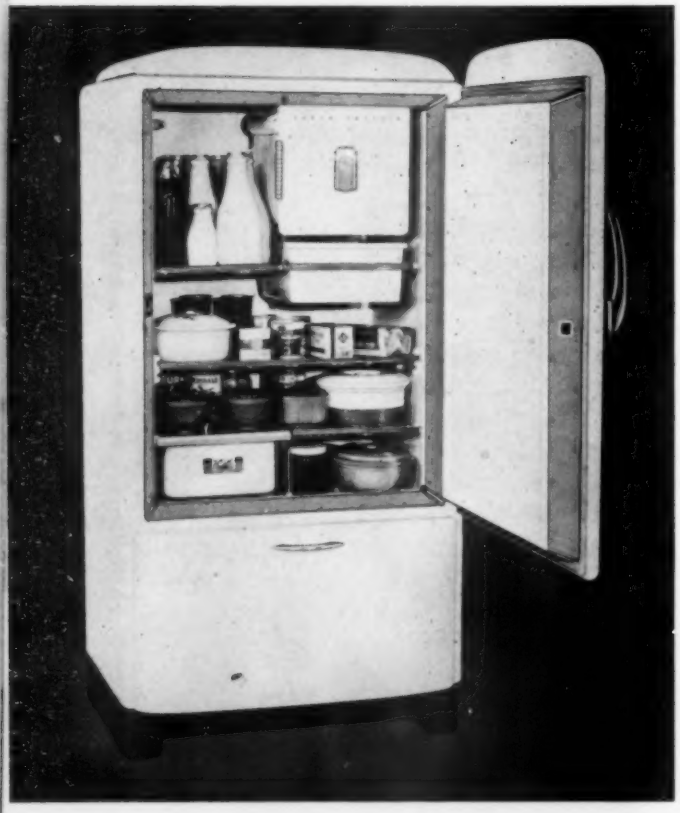
Where space is at a premium a combination kitchen - laundry provides all of the facilities with ample working area for each activity.



DOUBLE LAUNDRY

Compact arrangement of equipment provides two complete laundries in a small area and with plenty of working space.

ELECTRICAL EQUIPMENT FOR

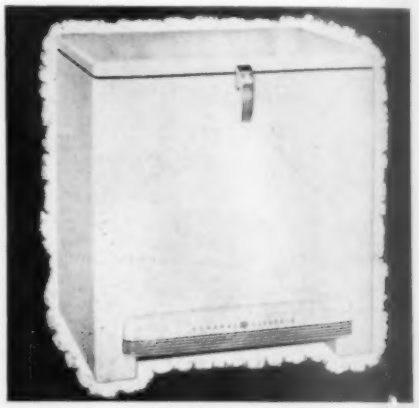


G-E REFRIGERATORS

Over a period of 20 years General Electric has earned and maintained a reputation for building the finest refrigerators money can buy. The G-E hermetically sealed refrigerating mechanism has established an unsurpassed performance record. The all-steel cabinet construction is rugged, rigid, and durable. Interior accessories have been tested for practical utility and economy in the G-E Consumers Institute laboratory kitchen. Model JB7-D shown at left is one of several applicable to school and university home making departments.

MODEL JB7-D

Dulux Liquid Plastic Exterior • Porcelain Interior • Height 56½" • Width 30" • Depth 26⅜" • Net Cubic Feet 7 • Shelf Area (sq. ft.) 11.8. ACCESSORIES:—10 qt. Vegetable and Fruit Drawer • 550 cu. in. Fresh Meat Compartment • 4 Freezing Trays (80 Ice Cubes —8 lbs.) • Sliding Shelf • Adjustable Shelf Spacing • Automatic Interior Light.



G-E HOME FREEZER

Models for freezing and preservation of frozen foods will be manufactured as soon as conditions permit.

G-E RANGES

For safety, cleanliness, and dependability in class room or demonstration cooking select a G-E automatic electric range. SPEED COOKING both on the surface and in the oven is provided by famous G-E Calrod cooking units which have established an unsurpassed record for long life and dependable operation. G-E exclusive features include the Tripl-Oven providing 3 ovens in 1—a Master Oven, Super Broiler, and Speed Oven; Tel-A-Cook lights that tell just how much heat is turned on — and where; No-Stain Oven Vent which dissipates cooking vapors away from walls and curtains.

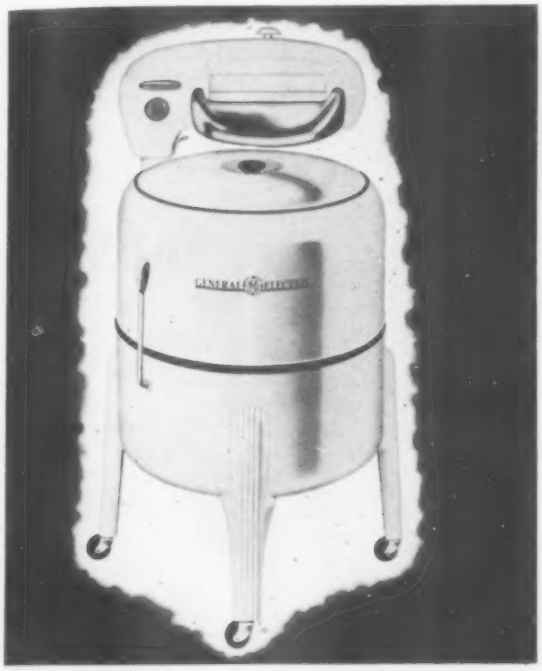
STUDIO MODEL

Where space is at a premium twin units of Studio models (instead of one standard model) provide increased surface and oven cooking space.

MODEL DD-2

(*Shown at right*)—Porcelain inside and outside. Height 36" • Width 39" • Depth 26½" • Oven 16" wide x 15" high x 2" deep • 5-Heat Calrod Surface Units • 7-Qt. 5-Heat Calrod Thrift Cooker • 2 Calrod Oven Units • 3 Storage Drawers • Calrod Warmer Unit. FEATURES—Hi Speed Calrod Units • Tripl-Oven • Tel-A-Cook Lights • No-Stain Oven Vent • Automatic Ovenminder • Minute Minder • Timed Appliance Receptacle • Electrikettle • Lamp • Condiment Set.

THE HOMEMAKING DEPARTMENT



G-E WASHER

The G-E Model AW322 Wringer Type Washer handles 8 pounds of clothes (weighed dry) at one time. The triple washing action supplied by the Activator is fast and yet is gentle on clothes.

The One-Control Wringer has the outstanding advantage of having only one control, which is used for all operations—starting, stopping and reversing the rolls, automatically tilting the drain board in the proper direction, and serving as a pressure release. A simplified mechanism is employed which has only four moving parts. No oiling necessary.

The above and other models including an automatic will be available as soon as conditions permit.

SPECIFICATIONS

One-Control Wringer • G-E Activator • Permadrive Mechanism—only four moving parts • No oiling required • Quiet washing operation • Porcelain enamel tub • Hand height activator • Quick emptying pump • Molded rubber plug • White baked enamel, rust-resistant finish.

G-E IRONER

The Automatic Flatplate Ironer, Model AF12, relieves women of the hard labor of ironing. The user sits down to iron and simply spreads the materials on the ironing surface with the hands. There is no moving roll, no motion of the appliance with which the operator has to keep pace.

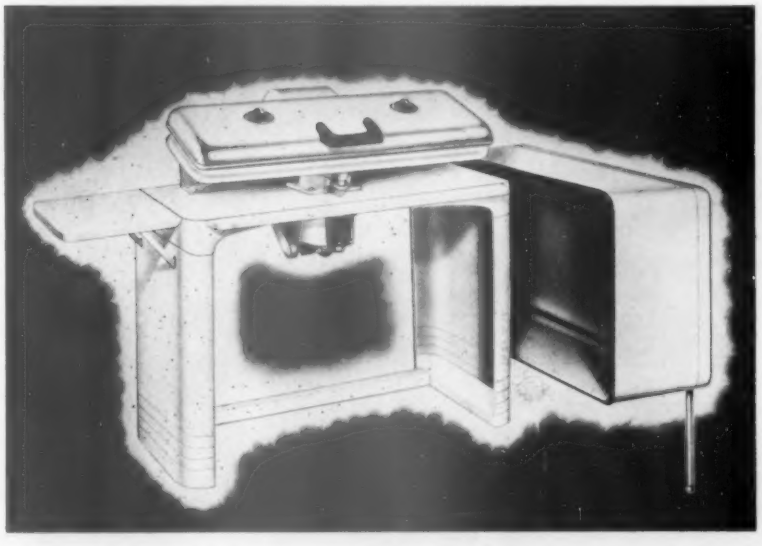
Then the handle of ironing shoe is drawn forward. When the shoe is in position over the ironing surface, the ironing surface automatically rises up against the heating shoe with 450 pounds of pressure. The ironing shoe is pushed back, and the material has been ironed beautifully, with a minimum of effort on the part of the user.

G-E DRYER

The G-E Tumbler Dryer, Model AD6, is particularly useful in classroom work as it eliminates the need for use of clotheslines and the labor of hanging out and taking in clothes. It will dry 9 pounds of clothes (weighed dry) at one time. Clothes are revolved slowly in a cylinder inside the appliance so that they are gently floated and cascaded loosely through pool of warm, clean air. They dry soft and fluffy, having received in effect, a thorough, windblown drying.

SPECIFICATIONS

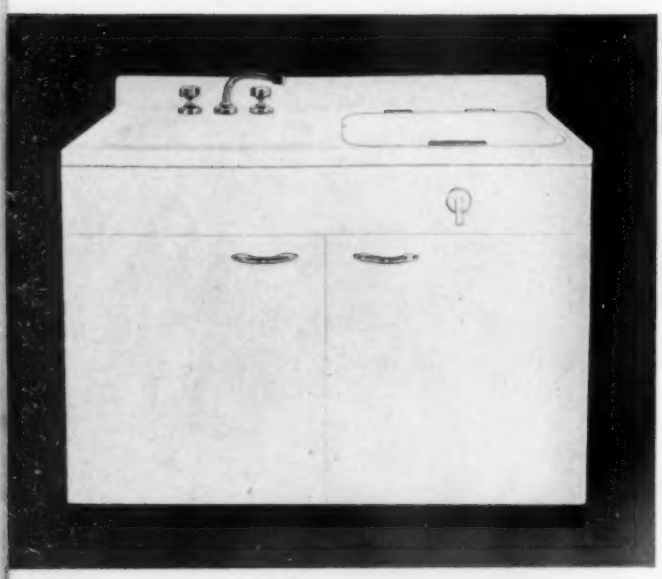
Time switch • Thermostat prevents overheating • Pilot light • Interior light provided for user's convenience in loading or unloading • A separate switch is provided for this light • Cabinet is of compact design, providing work surface • Finish is two coats of rust-resistant white baked enamel. Electrical rating, 230 volts A.C., 4600 watts. Molded rubber plug.



SPECIFICATIONS

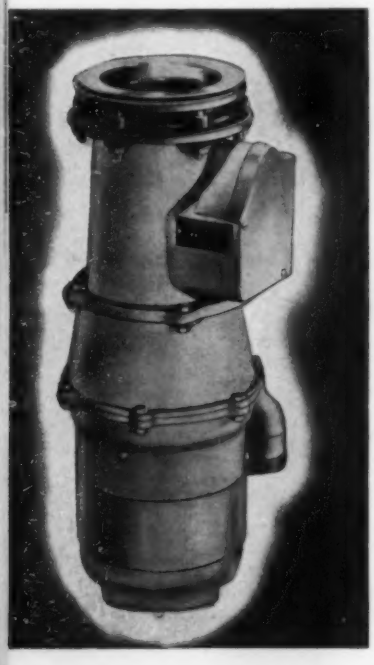
Attractive console cabinet, the top of which furnishes work surface when closed and affords generous shelf space when ironer is in use. Additional shelf is supplied at left hand end of ironer. Shoe is of polished cast aluminum. 300 square inches of ironing surface • Heating elements are the famous long-lived, G-E Calrod type • Thermostats maintain a smooth range of temperature from 225°F. to 475°F. throughout the entire area of shoe • Cabinet is finished in baked white enamel, rust-resistant • Heating shoe is of satin finish aluminum • Main switch turns off all power when not in use • Unbreakable soft rubber plug molded to cord.

ELECTRICAL EQUIPMENT FOR



G-E ELECTRIC SINK

The utility, sanitation, and convenience provided by a G-E Electric Sink makes it an extremely desirable piece of equipment for classroom or demonstration work. The attractive cabinet houses not only a sink, but a G-E Electric Disposall which makes quick riddance of waste foods, and the G-E Electric Dishwasher which washes, rinses, and dries dishes and silver automatically. Because an estimated 75 percent of kitchen operations take place at the sink, this appliance is a tremendous time and labor saver, and should be the keystone of any modern kitchen layout.



G-E DISPOSALL

The Disposall is securely attached to the sink in place of the old-fashioned perforated drain. Into it go all food waste, parings, rinds, meat trimmings, bones and all, where they are quickly shredded to a fine pulp and are washed away like w a t e r. There are no odors, as the Disposall cleans itself every time it is used.

G-E AUTOMATIC DISHWASHER

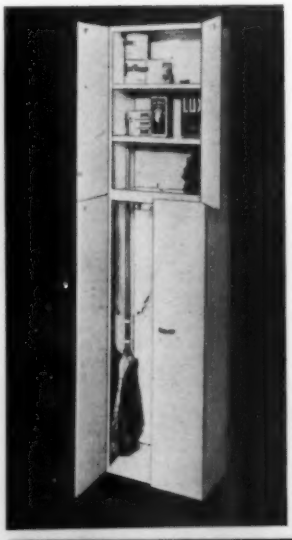
Washing dishes electrically is much more than a convenience. It is the safe, hygienic, modern method of cleaning dishes, glasses, silver, pots and pans. After dishes are placed in the racks and trays inside the dishwasher, merely flip the single touch control and within a few minutes the entire operation—washing, rinsing, and drying—is completed.

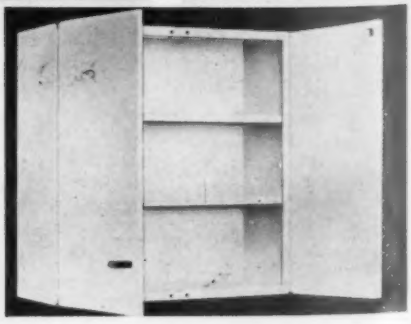
Dishes remain stationary, will not break from washing action.

The cabinet is finished in white baked glyptal enamel. This model permits considerable freedom in the arrangement of the cabinet as it may be installed wherever desired—either alone or in conjunction with other cabinets and appliances. Other models are available for dropping into existing built-in work surfaces.

G-E KITCHEN AND STORAGE CABINETS

Utility units, base and wall cabinets and even complete preparation, sanitation, and preservation "centers" are available in various shapes and sizes. Because these cabinets are entirely of steel, doors and drawers will not warp or stick.





THE HOMEMAKING DEPARTMENT

G-E TRIPLE WHIP MIXER

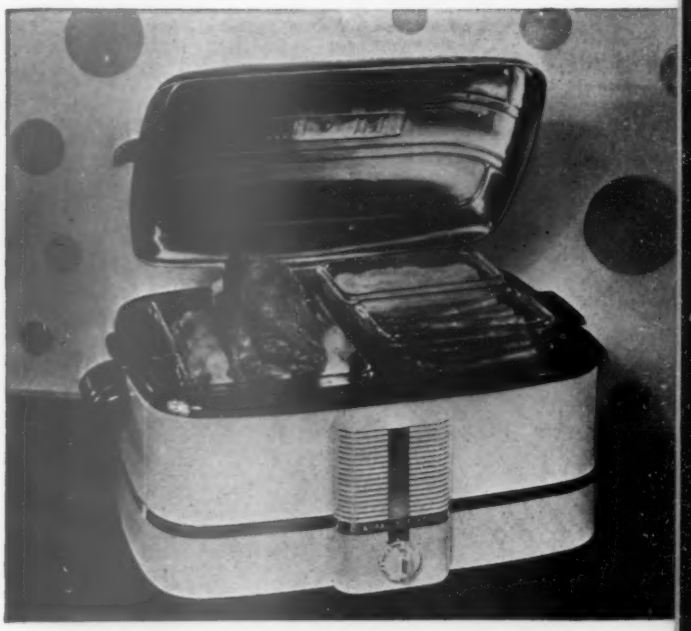
The Portable G-E Triple-Whip Mixer is a speedy automatic kitchen appliance that eliminates much labor and increases efficiency. It utilizes a multi-speed control of a powerful motor to mix, beat, whip, extract juice and with its various accessories will perform countless other tasks. Sturdy, compact and easy to store it is a necessary piece of kitchen equipment.

AUTOMATIC STEAM IRON

The automatic steam iron has all the features of the finest automatic irons plus controlled steam ironing for all types of fabrics. Weighs 4½ lbs.

AUTOMATIC COFFEE MAKER

Set it, forget it. Automatically at the push of a button the water goes up, coffee is brewed, returns to the lower bowl, shuts off the current and turns on a low heat to keep the coffee hot until ready for serving. Capacity—8 cups.



TEL-A-COOK ROASTER

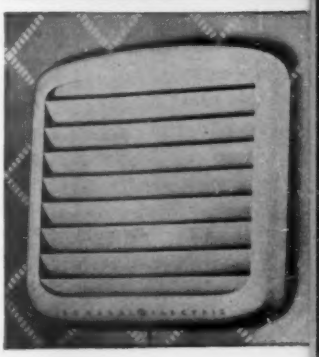
This utility cooking appliance is the last word in compact, cooking convenience. Its tel-a-cook lights tell all the cooking temperatures necessary for baking, roasting, boiling, frying, etc. It holds a 20 lb. turkey and is spacious enough to cook a complete meal for a family of six. Dimensions: 23 in. long, 16 in. wide and 12 in. high.

KITCHEN CLOCK

In attractive kitchen colors of smart plastic design. Self-starting with self-oiling reliable G-E motor. Size—7½" in width and 2½" deep.

KITCHEN VENTILATING FAN

This fan is indispensable for removing kitchen odors and smoke. Quiet running with white plastic grill. Adjustable to fit walls from 5½" to 11" thick.



ELECTRICAL EQUIPMENT
FOR THE
HOMEMAKING DEPARTMENT

IMPORTANT NOTICE

The General Electric Company has, of course, manufactured no appliances since the start of the war. Therefore the specifications given on the preceding pages apply only to the latest pre-war models. When appliance manufacture is again resumed, there will undoubtedly be changes in designs and sizes. As appliances again become available we suggest that you keep in contact with the G-E distributor serving your area for complete information. For your convenience and reference, a list of G-E major appliance distributors appears below:

City and State	*Distributor*
Albany, N. Y.	A. Wayne Merriam, Inc.
Albuquerque, New Mexico	Electric Supply Company
Allentown, Pa.	G-E Supply Corp.
Atlanta, Ga.	W. D. Alexander Co.
Baltimore, Md.	G-E Supply Corp.
Birmingham, Ala.	Matthews Elec. Supply Co.
Boston, Mass.	Boston Appl. Dist. Branch
Boston, Mass.	G-E Supply Corp.
Buffalo, N. Y.	G-E Supply Corp.
Butte, Mont.	G-E Supply Corp.
Charleston, W. Va.	Virginian Electric, Inc.
Charlotte, N. C.	L. W. Driscoll, Inc.
Chicago, Ill.	R. Cooper, Jr. Inc.
Cincinnati, Ohio	Cincinnati Appl. Dist. Branch
Cleveland, Ohio	G-E Supply Corp.
Columbia, S. C.	Perry-Mann Elec. Co.
Columbus, Ohio	Bard, Inc.
Dallas, Texas	G-E Supply Corp.
Denver, Colo.	B. K. Sweeney, Inc.
Detroit, Mich.	G-E Supply Corp.
Dubuque, Iowa	Crescent Elec. Supply Co.
Fargo, N. Dak.	Dakota Elec. Supply Co.
Fresno, Calif.	Valley Elec'l Sy. Co.
Hartford, Conn.	Orkil Electric Co.
Honolulu, T. H.	W. A. Ramsay, Ltd.
Houston, Texas	G-E Supply Corp.
Indiana, Pa.	Whiteman & Co., Inc.
Indianapolis, Ind.	Electric Appliances, Inc.
Kansas City, Mo.	G-E Supply Corp.
Lancaster, Pa.	Raub Supply Co.
Little Rock, Ark.	O'Bannon Bros.

City and State	*Distributor*
Los Angeles, Calif.	Los Angeles Appl Dist. Branch
Louisville, Ky.	G-E Supply Corp.
Mankato, Minn.	Southern Minnesota Supply Co.
Milwaukee, Wisc.	E. H. Schaefer Corp.
Nashville, Tenn.	G-E Supply Corp.
New Orleans, La.	G-E Supply Corp.
New York, N. Y.	New York Appl. Dist. Branch
Oklahoma City, Okla.	G-E Supply Corp.
Omaha, Nebr.	G-E Supply Corp.
Philadelphia, Pa.	Philadelphia Appl. Dist. Branch
Phoenix, Ariz.	Arizona Wholesale Supply Co.
Portland, Ore.	G-E Supply Corp.
Poughkeepsie, N. Y.	Electra Supply Co. Inc.
Providence, R. I.	E. Pulver Cook, Inc.
Raleigh, N. C.	Nash-Steele Electric Co.
Richmond, Va.	R. S. Montgomery, Inc.
St. Louis, Mo.	St. Louis Appl. Dist. Branch
St. Paul, Minn.	G-E Supply Corp.
Salt Lake City, Utah	G-E Supply Corp.
San Francisco, Calif.	G-E Supply Corp.
Seattle, Wash.	G-E Supply Corp.
South Bend, Ind.	South Bend Electric Co. Inc.
Syracuse, N. Y.	Gould-Farmer Co.
Tampa, Fla.	Florida Appl. Dist. Branch
Terre Haute, Ind.	Advance Elec. Co.
Toledo, Ohio	Commercial Electric Co.
Utica, N. Y.	Langdon & Hughes Elec. Co.
Washington, D. C.	G-E Supply Corp.
West Orange. N. J.	Newark Appl. Dist. Branch
Williamsport, Pa.	Lowry Electric Co. Inc.
Worcester, Mass.	Coghlin Elec. Co

APPLIANCE & MERCHANDISE DEPARTMENT
GENERAL ELECTRIC CO.
BRIDGEPORT, CONN.

BAVINCO MANUFACTURING CORPORATION

Designers and Manufacturers of
BAVINCO Home Economics Equipment
2745 Seneca Street
BUFFALO 10, N. Y.

The makers of BAVINCO Home Economics Equipment, whose interest in the school field is confined to the Home Economics Department exclusively, are recognized as the pioneers and leaders in the development, design and construction of Homemaking Equipment which creates *home atmosphere* in the school.

The Unit Kitchen introduced by BAVINCO is now universally accepted. Our designers, in cooperation with leaders in home economics education throughout the country, are continually developing new ideas in planning and equipping the school kitchen in accord with the latest trends in homemaking education.

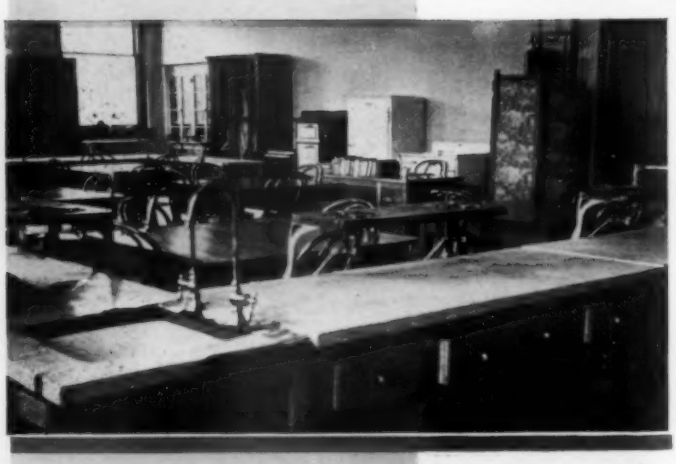
Creating Home Atmosphere in the School

Whether you are planning a department in a new school or the remodeling of an *old* department, BAVINCO Planning Service can be of real help to school architects, administrators and home economics teachers. The Home Economics Departments in hundreds of schools—large and small—public, parochial, private schools, colleges and universities—have been planned by BAVINCO. The experience thus gained is yours for the asking.

Foods

While "home atmosphere" is to be desired, the ordinary commercial type of kitchen cabinet is not suited to school requirements. BAVINCO equipment, altho "homelike" in appearance, is designed and constructed to stand the severe service required of school equipment. BAVINCO Unit Kitchen Cabinets are made by skilled cabinet makers who, through years of experience, have learned how to *build to last*. Add to the sturdy construction of these cabinets their smooth-as-silk BAVINCO enamel finish, in a choice of colors, and the easy-to-clean, modern hardware, and you have the ultimate in beauty and long wear.

The above photographs show installations of BAVINCO Foods Equipment in new schools. Both L- and U-shaped units are efficient and attractive. BAVINCO provides every modern convenience — to save steps, make the study of homemaking a pleasure, and increase homemaking efficiency.



The "before and after" photographs above show how an old out-of-date domestic science laboratory can be transformed into a modern efficient, beautiful homemaking department. No matter what the size or shape of the old department, our Planning Service can modernize it with BAVINCO Unit Kitchens.

Bavinco Planning Experts are at your service

Clothing

Whether your Homemaking program requires a formal sewing room, an all-purpose room, or a combination sewing room and living center, BAVINCO planners have designed equipment to meet the many problems that arise.

The formal sewing room at the right meets the requirements of a large school or college. Sewing tables have compartments into which fit the interchangeable drawers or boxes in which the individual pupil's sewing materials are stored.

BAVINCO provides cases for the storage of sewing materials, illustrative materials and charts, individual student boxes, etc.; sewing tables with compartments for interchangeable drawers or boxes; fitting stands; triplicate mirrors, and other items.

At the right is shown an all-purpose room in which all homemaking activities are provided for. The end of this room, not illustrated, is equipped with clothing cases designed for the all-purpose room.

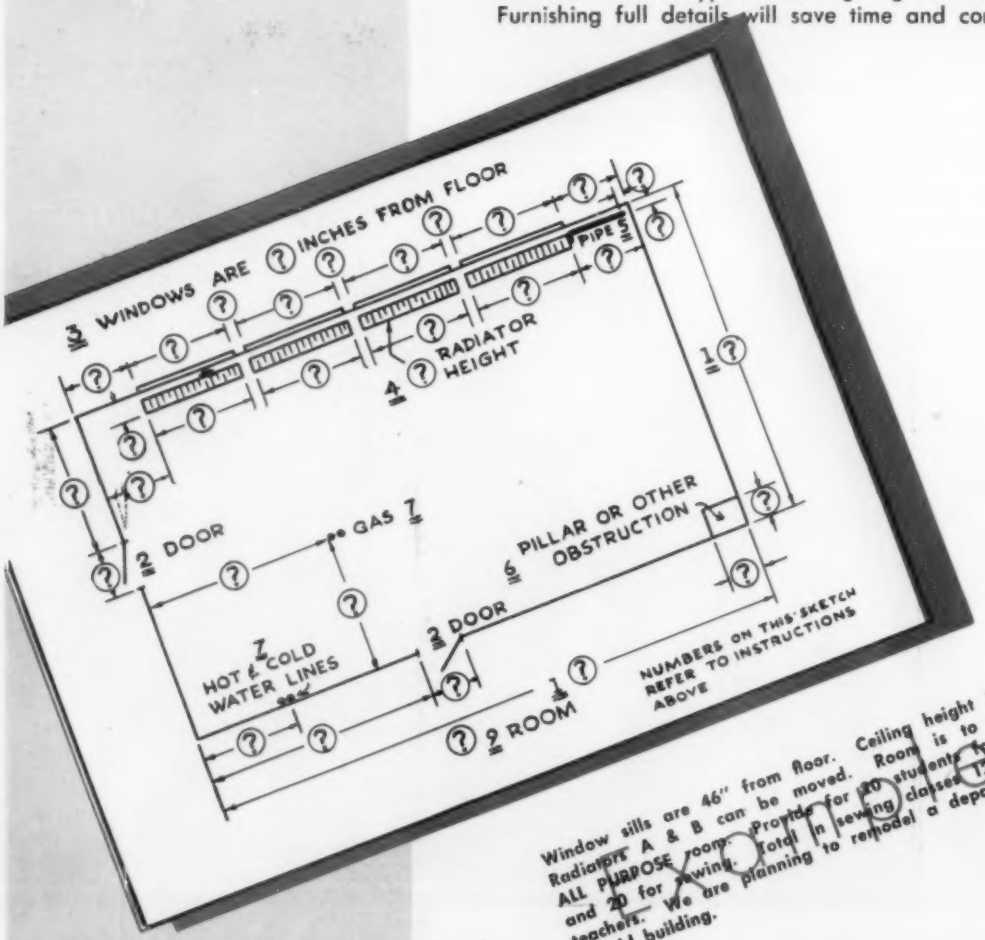
The following page describes our Planning Service

Bavinco Planning Service

BAVINCO Planning Service is available to schools without cost. Just send us a rough pencil sketch with the following information:

1. Size of room or rooms.
2. Location and size of each door and window including casing. (Please mention if any door or window can be moved or eliminated.)
3. Distance from floor to bottom of window sills.
4. Locations and sizes of radiators, univents, vent flues, pillars, pipes or other obstructions which might interfere with placing of cabinets or cupboards.
5. If any of the above could be relocated, please indicate.
6. State number of students per class to be provided for.
7. For a clothing department, state number in each class, also total number in all classes.
8. State number of teachers in the department.
9. Give full information as to purpose of room: foods, sewing, all-purpose, etc.
10. State whether planning for a new building or for a new department in an old building.

Below we show a typical sketch giving the information we need. Furnishing full details will save time and correspondence.



Window sills are 46" from floor. Ceiling height 11' 8". Radiators A & B can be moved. Room is to be an ALL PURPOSE room. Provide for 20 students for foods and 20 for sewing. Total in sewing classes 120. Two teachers. We are planning to remodel a department in an old building.

Address: Bavinco Manufacturing Corporation, 2745 Seneca St., Buffalo 10, N. Y.

MAINTENANCE AND OPERATION OF THE SCHOOL PLANT

Regardless of the character of new construction, the problem will remain of maintaining and operating buildings and grounds at their highest degree of efficiency. Management in this area is most important. There is much to learn, and constant study and experimentation are necessary to find better ways of handling the school plant.

Hundreds of widely different operations are required. It is difficult if not quite impossible for any one person to have understanding of and skill in all of them. Much can be learned from others. There must be a sharing of experience and research. The following articles are presented as the contribution of our authors to this important area.

ACOUSTICS IN SCHOOL AND COLLEGE BUILDINGS

By BEN F. McMURRY

Barber & McMurry, Architects, Knoxville, Tenn.

AN article on acoustics should not attempt to set school and college buildings apart as presenting a different problem or as needing a different type of treatment. The problems and needs are the same in all cases. The fact is, however, that less thought has been given to acoustical correction in educational buildings than elsewhere. A contributing factor, no doubt, has been money, or the lack of it. School building authorities have not clearly recognized that even from a financial standpoint acoustical correction is a good investment, that by only a slight increase in cost, conditions can be so improved that students and faculty do more and better work, with less bodily wear and tear.

Acoustical Treatment Now on Scientific Basis

Acoustical treatment should become standard practice for all types of rooms to be used for educational purposes. This applies especially to classroom and lecture rooms, auditoriums, gymnasiums, cafeterias, and swimming pool rooms.

Since the behavior of sound in a room is now thoroughly understood by those trained in this field and can be accurately computed mathematically, there is no need for guesswork as to where and how much acoustical treatment should be employed. We no longer seek to correct bad acoustical conditions by stretching wires through the room or by other tricks of magic, as was once the case.

For new work, the logical thing is to ascertain where acoustical corrective materials are needed, and how much, and then to incorporate them in the original construction of the building, so that no corrective treatment will need to be applied later. Those concerned with rooms that are now in use need not abandon hope, however, as corrective materials are available for every type of use, and there is no room that cannot be successfully treated.

There Are Three Types of Materials

Acoustical corrective materials, in general, divide themselves into three groups:

Ready-Mixed Plasters

Group I includes the various acoustical plasters. These materials are ready-mixed at the factory, are delivered in bags, are mixed with water on the job, and are applied by plasterers. They are among the least expensive of the acoustical corrective materials and produce excellent initial results if properly applied, with a high coefficient of sound absorption and excellent light reflection. Furthermore, their textures are pleasing to the eye, and they present continuous surfaces unbroken by seams or joints. Though suitable for ceilings and high areas of walls, they should not be used within reach of persons or where subject to hard usage as the surface is usually not hard and strong.

One objection to extensive use of this type of acoustical material is the difficulty of getting the plaster properly applied. A second objection, the difficulty of preserving its light reflecting qualities without a loss of its sound absorbing qualities, applies with special force in school and college buildings, particularly in classrooms. Where maximum light reflection is desirable, it is important that the surfaces be kept clean and light. Because acoustical plasters are somewhat porous and loose in texture, they accumulate dirt freely, making frequent cleaning or redecorating necessary. Painting for this purpose tends to reduce the acoustical efficiency quite rapidly.

It is claimed that certain types of paint do not reduce the sound-absorptive capacity, but, in most instances, ordinary paint is applied, which, after a few paintings, so completely seals the surface that it becomes practically valueless as an acoustical corrective material.

Composition and Metal-Jacketed Materials

Group II includes materials that are manufactured and marketed as a finished product, ready to be fastened in place. In this group are the various composition boards and tiles, and the metal-jacketed materials. This group includes all acoustical boards and tiles, perforated and plain, and perforated metal or other rigid materials which have some type of highly absorbent backing. These materials have a wide range of possibilities and can be used with equal ease in the construction of new rooms or in the correction of bad acoustical conditions in existing rooms.

The plain composition boards or tiles, included in this group, should not be used when the need for acoustical corrective material is at all serious. Although they constitute an excellent material for the construction of ceilings and walls if they are securely fastened in place, their value as an acoustical corrective material is quite low. The painting which is necessary from time to time also reduces what acoustical efficiency they have when new.

The perforated materials, which are manufactured and marketed as a finished product ready for application to surfaces needing treatment, are regarded by

architects as being the most effective and economical of all surface treatments. They are of two types: the perforated boards or tiles, and the perforated metals or other rigid materials backed with sound absorbents.

They are all based on the idea that sound, passing through the perforations, is absorbed by the soft receptive materials behind the surface. The perforations are sized so that any number of coats will not form a bridge over them. This type of corrective material thus retains its original high efficiency throughout its life.

The perforated tiles usually have small holes, or other types of perforations, arranged in pleasing geometric patterns. The variety of sizes and shapes of these tiles afford the architect a rather free choice in the development of architectural design.

The method of fastening perforated tiles in place is of great importance, particularly when ceilings are involved. They should be cemented in place over plaster or concrete ceilings by skilled mechanics experienced in this line of work, with the best of cementing materials, and under the supervision of an experienced sales representative from the manufacturer. If all these conditions cannot be met, the tiles should be fastened in place with nails or screws, otherwise there is danger that some of the tiles will come down.

The metal jackets, which are filled behind their perforated surfaces with one of the soft filler materials, provide the same decorative type of perforated surface as the perforated tiles; they can be

Courtesy of Johns Manville

Above — Cafeteria, University of Tennessee, Knoxville, Barber & McMurry, architects. Perforated tile was used on the ceiling to absorb clatter of dishes and all other cafeteria noises

Left—This room in the Junior-Senior High School, Pompton Lakes, N. J., suggests the decorative possibilities of acoustical corrective materials which come in many patterns

cleaned easily and painted as many times as desired without losing efficiency.

The metal-jacketed materials must be secured in place to fastening strip previously placed; but, once in place, they have no tendency to come down.

The perforated materials lend themselves admirably —in efficiency, cost, and architectural possibilities— to the correction of bad acoustical conditions in all types of rooms in school and college buildings.

Structural Units

Group III includes materials that are manufactured and marketed as a finished product for use in constructing the exposed areas of walls and ceilings. In this group are acoustical stones, tiles, and other rigid units usually laid up in the manner of masonry construction, or cemented in place to simulate masonry. In general, these materials, although beautiful and eminently satisfactory for rooms of a monumental nature, are too expensive for extensive use in usual school and college construction, and they are not as suitable for correcting bad acoustical conditions in existing rooms as are the perforated materials.

One material in this group may be an exception to the rule insofar as cost is concerned, and that is a purely structural unit made of cement and cinders or super-rock. In our experience with school and college building work, we have watched eagerly for the appearance of some sort of acoustical structural unit with which walls could be built, which would require nothing more than paint, at the most, for a finish, which would be economical in cost, and which would have a high sound-absorption value. Many of the manufactured acoustical stones and tiles meet these requirements in every way except in the matter of cost.

Structural units made of portland cement and cinders or super-rock come nearer to meeting this set of requirements than anything we have found. If the units are right in size and proportion, and if they are laid up carefully, they form walls that are fairly pleasing in appearance when painted. Their sound-absorbing value, if not equal to that of the perforated acoustical materials, is usually sufficiently high to make the use of other acoustical material unnecessary. They have the advantages of being structural in nature, comparatively inexpensive, and of needing no plaster.

Call in Specialists for Problems

This review is intended to cover the general field of acoustical correction only as encountered in everyday practice in relation to school and college buildings. Special problems, i.e., broadcasting rooms and music rooms, which really involve soundproofing rather than acoustical correction, should be handled by engineering specialists.

It is intended to urge a far more general use of acoustical corrective materials in school and college buildings than has been common practice in the past. Choice of the best materials for use in accomplishing the desired results should generally be left to the architects in coöperation with specialists in the various fields.

Classroom in primary unit, Tennessee School for the Deaf, Knoxville, Barber & McMurry, architects. To meet the need for exceptional quiet in this school where partially deaf children are taught to speak by means of hearing aids, structural units of portland cement were used on the walls and acousti-celotex on the ceilings of the classrooms

ECONOMIES IN PLANT OPERATION

By H. H. LINN

Associate Professor of Education, Teachers College, Columbia University, New York

ECONOMIES in the operation of the physical plant generally will be found in one of three major areas:

1. Personnel service
2. Utility provisions (heat, electricity, gas, water)
3. Operating supplies and equipment

Economies in Personnel Area

Because building service is largely personal, wages and salaries constitute the greatest item of cost in connection with plant operation. Economy, therefore, calls for: (1) selection of people for this field of work who are at least potentially capable, (2) proper supervision, (3) training or instruction, and (4) proper tools and equipment.

Selection of Employees

The development of an efficient staff must be considered from the long-term point of view since many of the present employees have more or less permanent tenure, and it must be expected that even those with limited ability will continue to stay at their jobs for many years. But, as positions open up, employees ought to be selected on the basis of higher qualifications than those that were acceptable in the past. Among the factors that should be considered are: (1) intelligence, (2) physical condition, (3) health, (4) age, (5) size, (6) experience, (7) education and training, (8) attitudes, (9) habits, (10) character, and (11) interest in this field of work. Persons of intelligence, vigor, ability, and interest in their work may be expected to render reasonably efficient (economical) service, particularly if they are given proper training and supervision. Those of limited capacity may prove to be a constant source of irritation because of their inability to learn or to perform their work satisfactorily.

Supervision

Some building service employees who have initiative as well as ability may be able to do good work without supervision, but the majority can be expected to render more efficient service when prompted and guided by competent supervisors. Despite this, in many of the smaller communities throughout the nation, the school custodians—often working alone in their one-man buildings—get practically no constructive supervision at all. Supervising principals, in many cases, do not know what constitutes efficient (economical) operating service, and their supervision consists largely of complaints of inadequate service when conditions get so bad they no longer are acceptable. It is appropriate to suggest that the people who occupy administrative positions with supervision of building services as one of their responsibilities should seek to learn about the field. They must have some knowledge of attainable standards, techniques, and procedures, if they are to assume responsibility for results.

In organizations large enough to assign supervisors to building service, it is important that the supervisory personnel be selected on the basis of ability. Promotion within the ranks—based on seniority or on being a "good fellow"—may result in the continuation of mediocre service or in the perpetuation of questionable practices. As the success of a large organization often reflects the quality of the man at the top, so the successful work of a building service group often reflects the quality of the supervisory staff. A potentially good group which has a poor supervisor may be no more productive than a poor

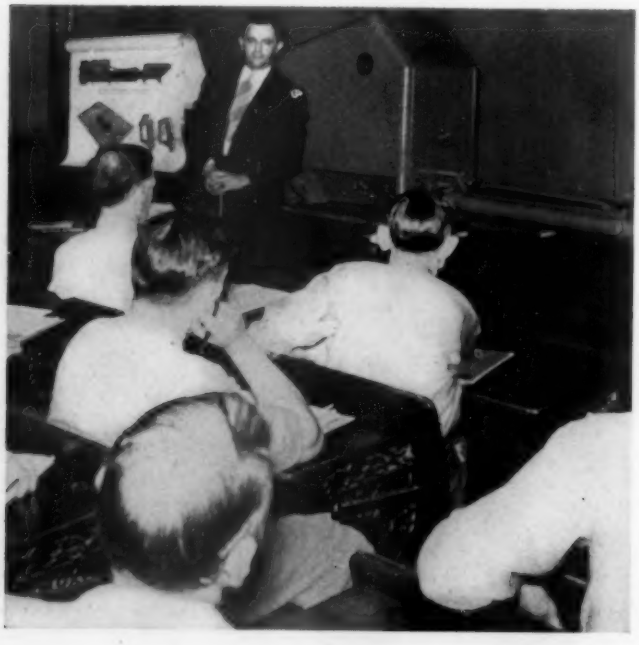
Janitor-engineer course, Kansas City, Kans., eliminates the costly process of learning jobs by the trial and error method

Damp-mopping is taught class in Topeka, Kans. Courses in service problems are given in an increasing number of cities

group with an exceptionally capable supervisor. For best results (efficiency and economy) there is need for both good workers and good supervisors.

Good salaries for good supervisors is a measure of true economy. Likewise, it may be said that good salaries for good workers is economy in the long run. Especially in the past, the low wages paid to building service workers have discouraged many able people from seeking service positions in the public schools

An itinerant instructor discusses stokers with a heating and ventilating class of building service employees in Kansas City



and other public institutions. More liberal policies dealing with wages, hours, and general working conditions should serve to attract a higher caliber of personnel in the future.

Training

Building service employees cannot be expected to develop to their full capacity without some instruction. In the past, many have had to learn their jobs pretty largely by the trial and error method—a wasteful process. Experienced operators may attempt to give some instruction to the neophytes, but many self-appointed teachers do not know the superior techniques of job performance or may not have a sound knowledge of what they are trying to impart. Thus they may help to perpetuate mediocre and questionable practices.

In recent years there has been growing recognition of the need for special training for school building service employees. A few of the larger cities have made local arrangements for in-service training, but only a beginning has been made. A number of educational institutions scattered throughout the nation have offered "short courses" dealing with service problems. These brief courses of from three to five days may be compared with the former teachers institutes of some thirty years ago. They serve to inspire those in attendance; worthwhile suggestions serve to assist those engaged in the work; round-table conferences provide for an exchange of experience and opinion; and demonstrations show improved techniques.

A number of state departments of education have sponsored such training, and a few of them have the vision to provide itinerant instructors or consultants who travel throughout their respective states, giving individual instruction and advice in some communities and, at the other extreme, meeting large groups of the employees at some central point within the state for an entire day—or possibly for several successive days. This sponsorship of "short courses" and the employment of an itinerant instructor and consultant gives great promise of promoting economy and efficiency in the operation of the school plant. The writer predicts that many additional state departments in the next few years will accept greater responsibility for providing such training and guidance.

Better Tools and Equipment

As far as the general cleaning operations are concerned, labor accounts for at least 95 per cent of the cost; supplies, tools, and equipment for not more than 5 per cent. Economy, therefore, dictates the use of supplies and tools that will secure the best results with the lowest labor costs. "Cheap" materials may actually prove to be more costly in the long run. On the other hand, it must be recognized that higher-priced materials do not necessarily produce better results. Common sense must be used in the selection of supplies and equipment, with the total cost of cleaning considered rather than the cost of supply items only.

It is not the first cost of the tools that is important but the low average long-term costs. Better types of tools and equipment may prove to be defi-

nite time savers in the way of labor. Electric scrubbing and polishing machines, for instance, may not only save time and effort and produce good results, but they may also serve to build morale. Employees appreciate the fact that management is willing to buy tools and equipment that will lighten and simplify their work. Their appreciation is expressed for good small tools as well as for more costly pieces of equipment.

Economies in Heating

There are many opportunities for effecting economies in connection with heating. These may be found in the following areas:

1. Fuel selection and purchase
2. Equipment design and maintenance
3. Operation of heating plant
4. Reduction in heat losses

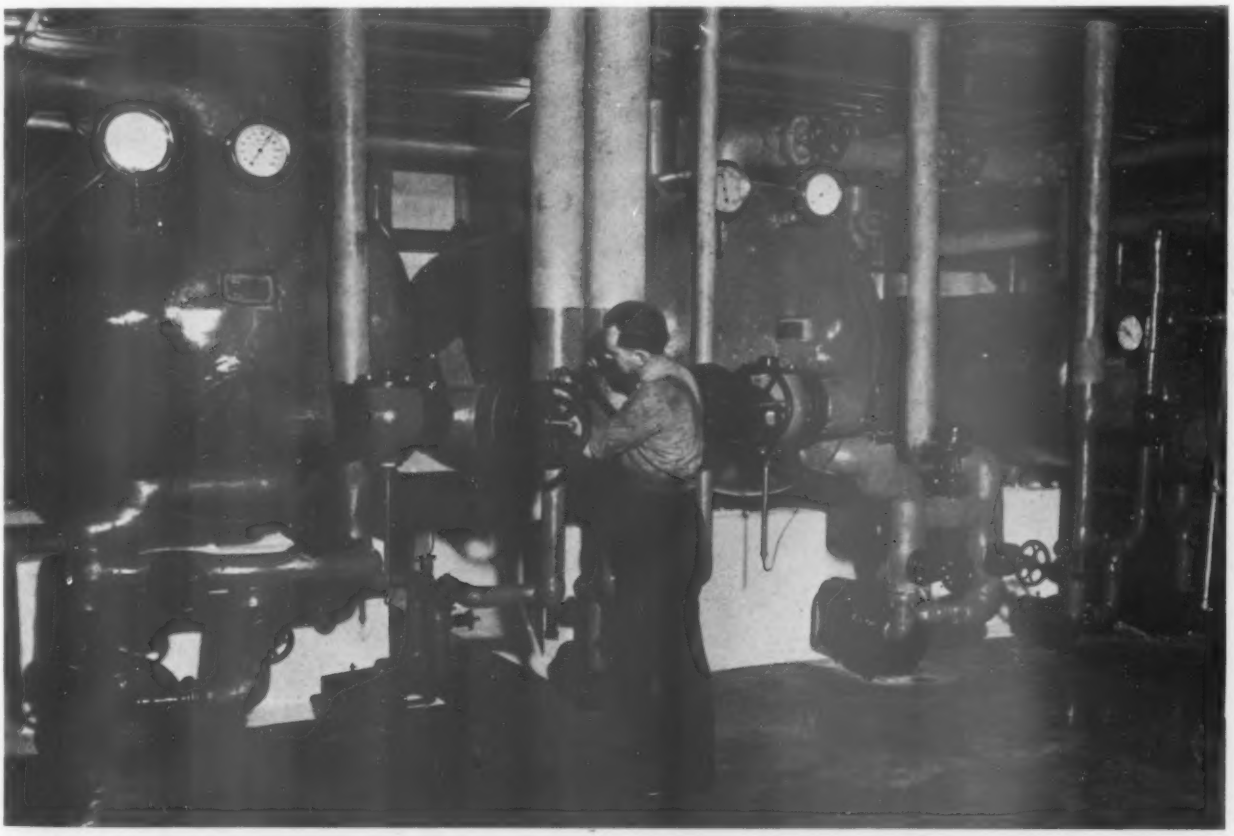
Fuel Selection and Purchase

There are different types of fuels available for heating plants: coal, oil and gas. (Wood and electricity can be eliminated from consideration in this article because of their relatively minor importance.) There are further variations in the basic fuels. Both anthracite coal and bituminous coal have wide variations. As to fuel oil, there are six grades with differences in BTU content. Gases also vary in BTU content.

In general, the smaller sizes of coal are lower in price per ton. Therefore, some economy may be anticipated if the smaller sizes of coal can be used without loss in efficiency and without requiring too much additional time on the part of the fireman. Many firemen prefer the larger and more expensive coal because it appears to simplify their work, but these men cannot always be given the privilege of choosing the fuel. On the other hand, the school custodian who does the firing may also have other duties to perform, and it may be more economical to buy the higher-priced coal which requires less personal attention. Then again, it may be possible to install stoker equipment in a hand-fired furnace to permit the use of the cheaper fuel and at the same time to free the fireman from rather frequent attention to firing. Each institution needs to study its heating plant in the light of its individual needs.

If fuel oil is used, the number 5 or 6 generally will be found more economical than one of the lighter but more expensive grades. The number 6 oil has a higher BTU content. As it is also generally lower in price than the number 5, it should be used if the local equipment permits. In some localities where the school buildings are allowed to cool off at night and over weekends, the heavier oil has presented difficulties when the fireman starts the early morning fire. An arrangement for preheating the oil may serve to overcome this difficulty in some instances.

When purchasing coal, the buyer should be aware of the fact that he is buying heat value and not just so many pounds of material. Therefore he must have information regarding the BTU content of the fuels under consideration. He wants a relatively high percentage of fixed carbon and volatile matter and as little ash, moisture, and sulphur as he must accept.



Hot water storage tanks and heating equipment, Abraham Lincoln High School, Brooklyn

The prospective supplier, when presenting his bid, should be required to submit an analysis of the coal he proposes to deliver. Later the buyer needs to take samples of deliveries and have a periodic proximate analysis made to ascertain how the deliveries of fuel compare with the promises. Many institutions provide penalties against the dealers for excessive variations in the coal analyses. Even if penalties are not applied, the periodic coal analysis has a moral effect in inspiring the dealer to fulfil his contract.

There is no single "best" fuel for all heating plants. The type to be used depends on many factors: (1) the type of equipment installed, (2) the availability of fuel, (3) the price of fuel and (4) the manpower requirements. In some cases, the higher-priced fuels will prove to be the most economical in the final analysis; in other cases, a cheaper fuel will prove to be the proper choice.

Equipment Design and Maintenance

Good operation is essential to the efficiency of the heating plant, but the operation may be seriously handicapped by poor equipment design and by poor maintenance. In designing the original layout, engineering advice is needed and engineering advice may be necessary to correct or to improve older installations. Thousands of heating plants in school buildings today could be made more effective through alterations or additions of special equipment. Some of these changes can be relatively minor and yet result in a decided improvement in the efficiency.

Too much faith has been placed in the claims of salesmen interested in selling their equipment, supplies, or service alleged to improve the heating plant efficiency. Stokers, for example, have a very definite place in many boiler rooms. They generally prove to be a good investment, but not always. In some cases, a good fireman who knows his job and who does it properly can get just as good results, *and sometimes better results,* by hand firing than by the use of stoker equipment. Admittedly, this is not the usual situation, but the point is stressed that the installation of a piece of equipment or a gadget recommended by a clever salesman does not necessarily produce expected results. Salesmen occasionally advise the installation of improper or undersized equipment in order to meet the competition of other salesmen bidding on improper or undersized equipment, and the buyer is the ultimate loser. When fundamental improvements are under consideration, the unbiased judgment of a competent heating engineer should be sought rather than the advice of the equip-

". . . changes can be relatively minor and yet result in a decided improvement in efficiency." Adjusting air damper on oil-burning boiler, Brooklyn High School, New York

ment salesman. This applies particularly to a public institution that must call for competitive bids. A private institution that can buy freely on the basis of merit rather than on the basis of price probably gets more honest advice from the equipment vendors.

Many changes can be made in the equipment design and layout to improve the efficiency or economy of the heating plant. A change in the type of grates, or installation of a blower may permit the use of a smaller-size fuel. A stoker, or possibly oil-burning equipment, may be installed. A boiler may be raised to increase the combustion space in the furnace. Baffles may be built or dampers installed in new locations. Auxiliary equipment, such as automatic pumps, may be provided with improved results. The height of a smoke stack may be increased. New control valves may be added. Temperature regulating equipment may prove a profitable investment. Instruments used for checking combustion, such as CO_2 indicators or recorders, draft gauges, and stack thermometers, are almost a "must" if a constant check on the efficiency of plant operation is to be maintained.

Even an efficiently designed heating plant must be properly maintained if it is to remain serviceable. Deterioration is constant and necessary repairs must be made promptly to keep all parts of the equipment operating satisfactorily. While the repair may entail expense, the failure to attend to it may result in far greater loss through excessive fuel consumption. It is particularly important that the instruments used for checking combustion be kept in service and that the instruments themselves be frequently checked for accuracy. If the instruments are not accurate, they may record false information and hide the fact that the plant is not operating efficiently.

Operation of Heating Plant

Regardless of the type of heating plant involved, or of the type of fuel used, efficiency in the operation of the plant depends in large part on the human element. The person operating the system must know the "what," "when," "how," and "why" of the various operating steps and procedures. And he must have the initiative and ability to perform his duties properly. The fact that a man knows how to operate a plant is no guarantee that he will do so. He may be lazy or indifferent. Some of the incidental tasks are dirty, hot, and disagreeable, and he may attempt to escape some of this work despite his knowledge that by doing so he will get inferior results. For example, the cleaning of boiler flues is a dirty job, but it is an essential one (for economy) because the soot deposit serves as an insulating agent and reduces the efficiency. Because it appears easier, the fireman may load the furnace with a heavy charge of fuel at intermittent periods instead of firing lighter loads at more frequent intervals. The writer is reminded of a licensed fireman allowing three boilers to loaf along with a low efficiency rating during the early fall when he could have maintained all heat requirements with a single boiler. But a single boiler would have required constant attention while the three boilers received a charge every half hour, allowing the fireman to sit in a chair most of the time.

By and large, it must be admitted that school heating plants are operated at a rather low efficiency level, due—in large part—to the careless method of selecting the men who do the firing and to the lack of adequate instruction and supervision. This is particularly true for the smaller communities, but many cities also exhibit this weakness. Too often a man who has had no experience with large-scale firing is employed to serve as "janitor" in a system which has no person competent to instruct him. Such a janitor may be able to produce enough heat to keep the occupants of a school comfortable during the winter, but his operating practices may be deplorable and no one may be the wiser.

Although some of the men may have instruments for checking the efficiency of combustion, they may not know how to use them or how to interpret them. Too often they ignore them totally. Their personal theories about firing may be grossly in error and may result in substantial fuel losses. For example, they

Gas analysis test for determining percentage of CO_2. To ensure accuracy, testing instruments themselves should be checked

may admit enormous volumes of excessive air into the furnace, believing that the additional oxygen improves combustion efficiency. Or they may disconnect draft regulators on the assumption that a steady powerful draft is essential. Or they may leave firing doors open when they leave the room as a "safety" measure. The writer once visited a school where the custodian refused to clean the soot from the boiler flues during the heating season, on the grounds that by doing so he made the rooms unbearably warm for the teachers and children. The larger cities can well afford to have a competent engineer on the school staff to instruct and check the heating plant operators. The smaller communities may be denied such service under present conditions. The suggestion is offered that state departments of education should provide advisory service in this field, possibly through an itinerant instructor and consultant. The aggregate savings to the schools throughout the state should exceed by far the cost of any such state-centered service.

Reduction in Heat Losses

Most of the heat generated in school buildings is for the purpose of heating the air so that the occupants are comfortable. A smaller amount is used to heat water for general washing purposes.

Economy in operation calls for the conservation of heated air, within the limits of health and comfort requirements for the occupants of the buildings. This means that heat losses should be restricted. Insulation, weatherstripping windows, or caulking window frames are examples of measures that may reduce heat losses. In the future, the installation of double sheets of window glass along the lines of the recently developed "thermopane" may prove to be a sound investment.

Control of ventilation may also result in substantial economies. In some buildings, ventilating fans are operated to introduce a larger volume of fresh cold air from the outside than is needed to provide proper ventilation. Or these fans may be operated earlier in the morning—or later in the afternoon than required—since buildings may be largely vacated at such times; such scheduling is wasteful of fuel when the purpose is ventilation rather than heating. A substantial portion of air in a school building may be recirculated, so that it is not necessary to bring in a steady volume of cold fresh air which has to be heated to the proper temperature before being introduced into a room and then just blasted out into the atmosphere again. It is not at all unusual to find windows in school buildings open during cold weather, even though other ventilating provisions may have been made. Much heat is lost because of such excessive ventilation.

It may not be necessary to have all areas within a building heated throughout the day. Unoccupied rooms, for instance, may have the heat shut off, or at least held down to a level that will prevent freezing. An auditorium that may be vacant for a half day or longer does not have to be heated to normal temperature levels during this time.

Temperature Control

Reasonable temperature levels should be determined for different areas within a school building, and an attempt should be made to maintain such standards. Any temperature higher than necessary during the heating season is reflected in the fuel cost. In general it may be said that a temperature range of from 68°-70°F is appropriate for the average classroom. Corridors need not be over 65°F, with toilet rooms not over 60°F. A gymnasium may drop to 55°F. Shops may be comfortable at from 60°-65°F.

Automatic temperature control may be installed to assist in holding temperatures to a predetermined level during cold weather. The more elaborate control systems may be applied to the individual radiators or heating elements within a room. A less elaborate temperature control system may provide a zone control on an area basis rather than on a room basis. There also are automatic temperature control devices that operate with an entire building as a unit. All of these controls have merit, and the final choice must be based on local factors. The point to be stressed in this article is that excessive temperatures in schools during the heating season mean fuel waste, and some type of automatic control may prove to be a measure of economy.

The simplest temperature device to be used in a schoolroom—although it is not automatic—is an ordinary thermometer. This instrument, of course, does not itself effect any control, but it ought to guide the individual teacher so that he or she can regulate the control manually when there is no automatic system. The practice of throwing open a window to cool an overheated room is wasteful. The heat should be regulated so that the room does not become overheated in the first place. Where no automatic regulation is provided, individuals must accept this as one of their responsibilities.

Economies in Electricity

Economies in the use of electricity may be effected by:

1. Securing a reduction in the rate structure, or by
2. Reducing the consumption of electric energy

Securing a Reduction in the Rate Structure

School officials should be sure that their institutions are placed on rate schedules that are the most economical for their particular classifications. In some instances it may be possible to secure a joint or combined billing for all schools within a district, thus getting the benefit of lower rates on a sliding scale for additional blocks of energy. In some cases it may be possible for the school people to initiate action or to bring pressure that will result in a more advantageous rate schedule. Any argument advanced by the officials of a local utility that the rates are determined by a state utility commission—rather than by the utilities themselves—may be questioned. While it may be true that a state utility commission *approves* a specific schedule, this does not necessarily mean that the commission initiated and promulgated the schedule. Utilities themselves have the power to propose new schedules and changes in old ones which, however, must generally be approved by the appropriate state commission before they can be placed in service. There is nothing to prevent school authorities from presenting their views regarding electricity

rates to the state utility commission if the local utility officials fail to make a satisfactory response.

Since different rate schedules may be established for light and power (and possibly heating) such services should be separated when economically feasible, with individual meters for purposes of recording. It may not be amiss to state that wiring plans occasionally get confused, creating excessive costs, because the lower-priced units actually are recorded on the meter serving the higher rate schedule.

Reducing Waste of Current

When discussing a possible reduction in the consumption of electric energy, it should be emphasized that this applies to a reduction in the *waste* of current and not to the *use* of current. There is a vast difference. In general it may be said that electricity —properly used—is cheap. Electric energy—improperly used or consumed without some compensating benefit—is wasteful. Economy lies in the reduction of such waste.

It appears that in schools one of the greatest sources of waste results from the needless burning of lights for artificial illuminating purposes. Again it should be emphasized that the use of electric current for the purpose of providing adequate levels of illumination in occupied areas within the building is entirely proper. As a matter of fact, relatively few school buildings have proper artificial lighting facilities to provide adequate levels of illumination, and it appears safe to say that the schools throughout the nation collectively could justify doubling the consumption of electric current for lighting purposes. However, this article is dealing with the general problem of economy, so that aspect will be analyzed further.

Lights are often found burning in unoccupied areas, and to a great extent this represents waste. Lights also may be burning in rooms where natural illumination is sufficient for the needs. Interestingly enough, school buildings are designed with a great expanse of window area to admit of natural light, and then window shades are drawn, thus counteracting the very purpose of the window areas. Teachers should be instructed to adjust shades to secure the optimum benefits of natural illumination, with proper consideration being given to possible effects of excessive light or glare resulting from the sunlight. Drawn shades may be entirely appropriate at certain periods of the day but may be worse than useless at other periods. It is particularly important that the upper sections of windows be uncovered, as it is the light from this area that has the greatest benefit for the occupants farthest from the windows.

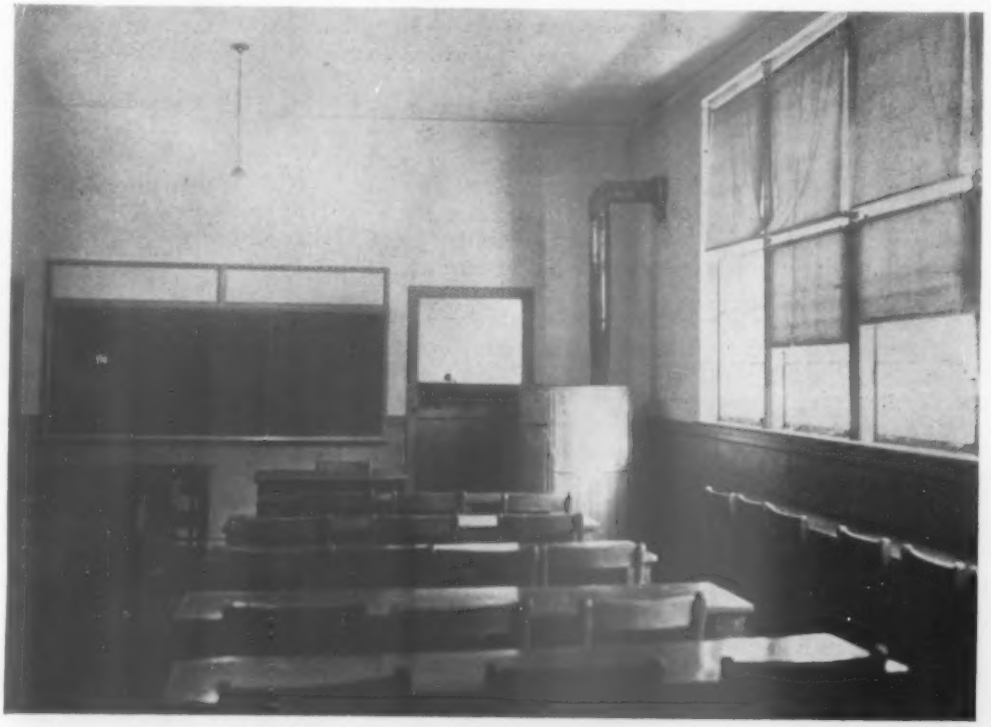
In some cases it may be proper to burn a row of lights serving the inner portion of a room while the windows serve the remaining area.

Since the transmission of light through glass is impeded when the glass is dirty, an attempt should be made to keep windows and light fixtures reasonably clean. The transmission of light may be reduced as much as 25 per cent because of the atmospheric soiling of glass over a month's period. Therefore, a standard of cleaning which calls for the monthly washing of window and light fixtures may be considered a measure of economy if it results in a reduction in the consumption of electric energy.

Improving Installations

There may be areas within a school building where lower levels of illumination than those provided may be adequate. In such cases, smaller lamps can be used with economy. But again the warning should be uttered that levels of illumination in schools are more likely to be too low, rather than too high.

Light circuits in corridors can be arranged with alternate lights staggered, so that only half the lights



". . . the use of electric current for the purpose of providing adequate levels of illumination is entirely proper. As a matter of fact, relatively few school buildings have proper artificial lighting facilities to provide adequate levels of illumination"

Courtesy of Graybar Electric Company

will be used at times when all lights may not be needed.

Some types of light fixtures are more effective than others as far as the transmission of light through enclosing shades is concerned. It may prove economical to discard some of these inefficient types of fixtures and replace them with more efficient types.

Single lamps of larger size may produce higher levels of illumination than clusters of smaller lamps consuming more current.

The color of the ceiling will affect the level of illumination. A white color has the highest reflection factor. While wall colors also will influence the level of illumination, the ceiling color has a more pronounced effect on the lighting results.

In general, fluorescent lighting produces higher levels of illumination with a smaller consumption of current than incandescent lighting. The cost of fluorescent fixtures and lamps must be considered when studying relative costs of these two types of lighting. The greatest economy can be anticipated where the lights are operated over extended periods of time, as the saving in the cost of current then tends to offset the higher cost of the fixtures. In some of the older buildings that do not have sufficiently heavy wiring to permit an increase in the present incandescent light load, the installation of fluorescent fixtures may increase the levels of illumination quite sharply without requiring an extensive and costly rewiring job.

One scheme that has met with success in reducing the waste of electricity provides for the posting near each light switch of a small card, about 4x6 inches in size, carrying the inscription "Please Turn Off Lights When Not Needed." The posting of this card, however, does not carry much weight over an extended period of time unless a follow-up program reminds the teachers from time to time that a campaign is being carried on for the reduction of waste in the use of electricity. These periodic reminders can take the form of monthly bulletins, and they will have additional meaning if specific information is given to show how the consumption of electricity for the previous month compared with other months, and particularly for the same month the year before. Charts or graphs, and tables, showing how consumption and cost of current (by months) have varied over a period of at least a year, encourage a continuation of the economy campaign. Similar charts can be constructed to point out the use of the other utility services, such as heat, gas, and water.

The operation of electric motors accounts for a substantial consumption of current in the average school building. Through control of the operating time element, economies may be possible. For example, ventilating fans can be started earlier in the morning than necessary, or can be continued later in the afternoon than actual requirements warrant. With proper scheduling, operating use can be curtailed without the loss of any essential benefit. The same thought should be given to all other types of motorized equipment.

Some shops are equipped with large motors designed to furnish power to a battery of different machines, through the use of an extensive system of belts and shafting. At times, with the large motor in operation, only one or a few of the machines may be in service. In some cases, the consumption of current can be reduced substantially by revamping the power service and providing individual motors for the machines.

Some buildings are equipped with old or inefficient motors that should be junked and replaced.

Economies in Water Usage

In many communities the public schools are not required to pay water bills since another municipal department provides this service. Because of this fictitious "free" service, the school authorities often fail to effect the reasonable economies that might be made quite readily. Such carelessness cannot be condoned since such waste represents loss to the community at large. The following suggestions may be helpful.

1. Keep a record of water usage and make a chart to show how the consumption varies from meter reading (monthly or quarterly) to meter reading, and investigate startling variations. Hidden leaks that develop may be exposed by this record.

2. Urinals that are flushed by an automatic syphoning device may be flushing much more frequently than necessary. Most school urinals (except where service is very heavy) need to be cleared no more often than once every ten minutes during the school hours. This automatic flushing should be shut off at night and over weekends when no service is required.

3. Continuous flowing drinking fountains cause a great waste of water.

4. Lawn sprinkling preferably should be done in the cool of the evening rather than during the heat of the day.

5. Leaks in faucets and valves should be given prompt attention. Leaks in hot water lines not only result in the waste of the water but also in the waste of the fuel used to heat this water.

6. Swimming pools do not have to be emptied and refilled at frequent intervals if the water is properly chlorinated and if the pools are kept reasonably clean and sanitary. The writer is reminded of a school that changed the pool water every week on the ground that the municipality made no charge but overlooked entirely the substantial cost of fuel required to raise the fresh water to a proper temperature.

Economies in the Use of Gas

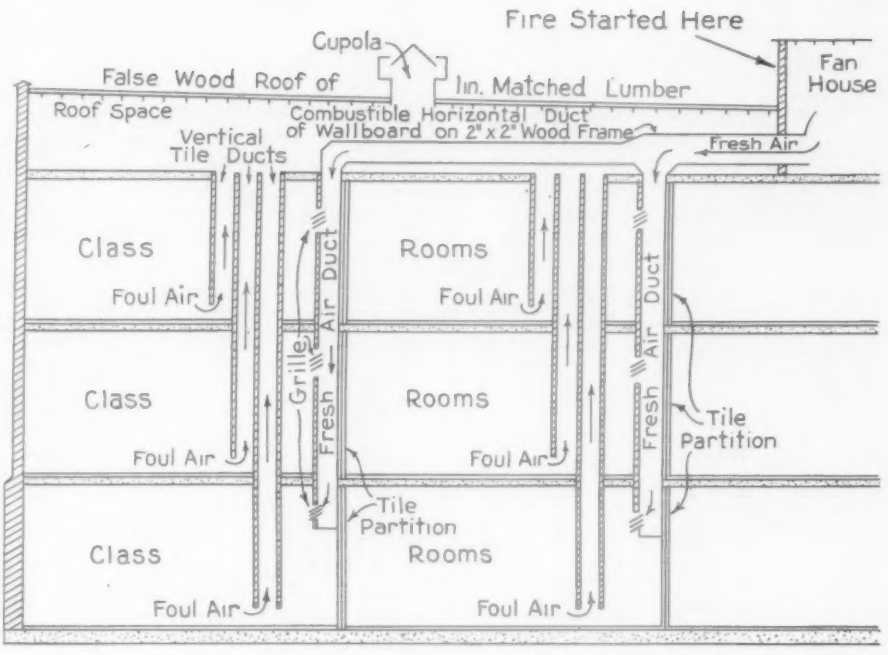
Gas is used for a variety of purposes: (1) heating, (2) cooking, (3) lighting (occasionally), and (4) laboratory use.

When gas is used as a fuel for heating, economies can be effected through: (1) proper operation of the gas-fired equipment, (2) temperature control, and (3) prevention of waste of heated air.

When gas is used for cooking (1) fires should not be lighted in advance of needs, (2) lids and covers should be used for appropriate cooking utensils, (3) heated ovens should be used to capacity or for several dishes at the same time when this is practicable, (4) the flame should be lowered after water has been brought to boiling point, (5) gas appliances should be properly adjusted for most efficient service, and (6) fires should be turned off promptly when the heating needs are met.

In laboratories, gas appliances should be properly adjusted and should be lighted only as the needs justify. Too often gas burners are lighted over extended periods of time with very limited actual use.

Public Grade and High School, Pipestone, Minn. March 17, 1939. Fire was discovered about 11 A.M., when smoke was observed coming from a fresh air grille in the hallway. The janitor traced the fire to the ventilating fan penthouse, but because of heat, was unable to reach the control room to shut off the fans. Due to an efficient fire drill, 1200 students and 47 teachers left the building in an orderly manner. The building was of three-story, fire-resistive construction, but had a wooden false roof under which combustible ventilating ducts extended to vertical air ducts leading to the classrooms. When the fire department arrived, the combustible roof structure was ablaze and flames from a fresh air duct had ignited the third floor library. Other small fires occurred throughout the building due to combustible materials from the roof dropping down the ducts. The most serious of these ignited the janitors' supply room and spread to the adjacent hallway. Considerable water damage resulted from use of hose streams in fighting the roof fire and smaller fires throughout the building. The total loss was about $150,000



PREVENTION OF SCHOOL FIRES

By WARREN Y. KIMBALL

Supervisor, Department of Fire Record, National Fire Protection Association, Boston, Mass.

PUBLIC educational officials appear to have learned much of the essential lessons of life safety from fire following the experience of several outstanding school fire tragedies earlier in the present century. With the exception of the demolition of the New London, Texas, school by a gas explosion with a loss of 294 lives in 1937, there have been no major holocausts in public schools during the past decade.

This improved life safety record, no doubt, reflects an appreciation of the importance of training in fire exit drills, proper arrangement of exits, and prevention of panic. There have been a number of fatal fires, such as the ignition of clothing in chemical laboratories. There have been several major fire disasters in dormitory buildings of educational institutions, where the dormitories were not of proper construction and the arrangement failed to give occupants a reasonable chance to escape. There have been fatalities to firemen engaged in fighting school building fires.

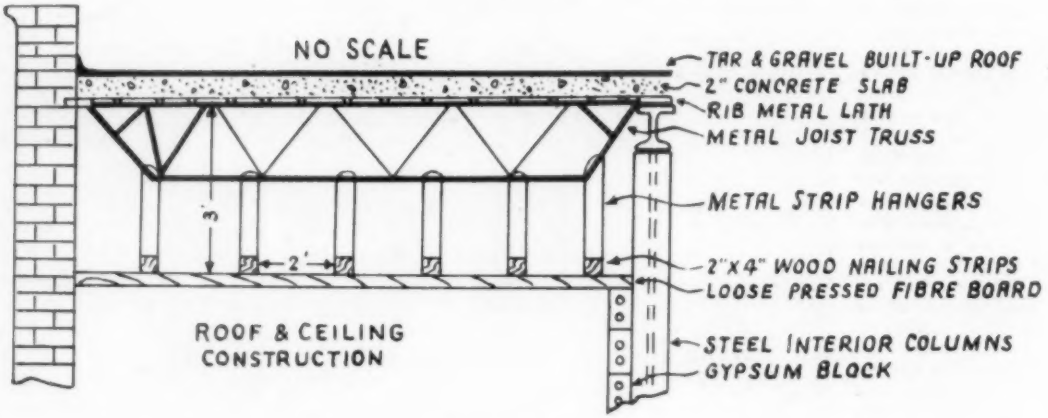
Not Even Modern Structures Exempt from Fire

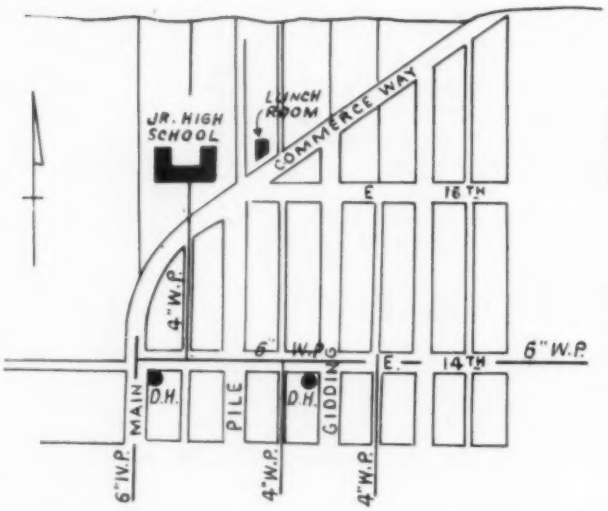
The fact that the loss of children in school fires has been reduced in recent years is no cause for a conclusion that the problem of school fire safety has been controlled or eliminated. School fires are occurring with increased frequency and with heavier monetary loss. The National Fire Protection Association estimates that 2500 fires in schools and colleges caused $8,200,000 loss in the United States in 1943, an increase from 2,400 fires and $7,300,000 loss in 1942.

If these fires had occurred only in hours when the buildings were unoccupied and had destroyed only the more obsolete school buildings, educational officials might have worn concealed smiles at the incidental prospect of obtaining better educational facilities. Such, however, is not the case. The more modern buildings are proving to be extremely vulnerable to major fire losses. Apparently, fire resistance has not received ample consideration when plans for many supposedly modern school buildings have been approved. Exit facilities may appear ample to remove the occupants, but that provision alone, no matter how desirable, does not make a structure fire safe.

Faulty Design Creates Fire Hazards

All thinking persons will realize that prevention of school fires must begin with proper design for the structure. Both educational officials and fire safety authorities recognize that the old type of school building, which has brick exterior walls and an all-wooden interior with a large open stairwell extending upward through the structure like a chimney, does not provide a safe type of school building. Unfortunately, it is not realized that many of the most modern school buildings have inherent faults of design almost equally as serious from a fire safety standpoint. Prevention of fire damage in school buildings means much more than mere control of rubbish disposal, proper handling of oily cleaning materials, or proper





A fire which caused $50,000 damage in this junior high school, started in the art department where painting supplies had been stored in wooden lockers. The conclusions from the report of the inspection bureau:

This loss clearly demonstrates the disastrous results of a fire occurring in a combustible suspended ceiling below a concrete roof supported on unprotected steel.

Combustible concealed spaces should be divided into small sections by adequate fire stops to prevent rapid spread of fire.

Water mains should be extended and an adequate number of hydrants installed at risk at same time buildings are constructed in outskirts of cities. Due to hydrants being over 1000 feet from this building, it was necessary to use all available hose to supply but two fire streams

inspection of electrical wiring. Fire prevention means the control of inherent hazards that would result in a serious loss and possible fatalities should fire occur. Unless school officials recognize these hidden hazards, it is not likely that the defects will be controlled, and other fire prevention efforts will be rendered futile. Fire safety recommendations made by the fire department or other fire safety agencies will carry little weight, and will seldom be put into effect, unless the school officials themselves have reached the conclusion that such recommendations are sound and are a reasonable expense.

School department officials should take upon themselves the primary responsibility for securing and maintaining fire safety in schools. Maintenance department officials should be encouraged to make recommendations that, if carried out, will result in greater fire safety in school buildings.

Insurance Reports Furnish Record of Experience

A true appraisal of fire experience can seldom be made from the usual local newspaper ballyhoo following a fire. Press accounts telling who carried out the office records and extolling the accustomed heroism of the firemen, while adding local color, seldom help the school officials to reach a clear understanding of just why the fire was not controlled and how a repetition might be prevented. Except in the larger cities, an appraisal of a fire by the local fire officials may not prove of much help to the school officials because it is likely that the average fire department has had comparatively little previous experience in the control of serious school fires. It would be very advantageous if reports by competent fire protection engineers on all important school fires were included in leading periodicals in the educational field. The insurance engineering organizations having jurisdiction in the fire area usually prepare such reports which give the reasons why a serious loss has occurred and indicate the effects of construction, fire protection facilities, and fire fighting methods employed.

Most of the reports of large losses in school fires indicate that the fires have occurred during hours when the buildings are unattended. This is fortunate from a life hazard point of view but, of course, cannot be counted on as an excuse for relaxing fire drill exercises. The Buildings Exits Code of the National Fire Protection Association contains a chapter outlining the fundamental requirements necessary for reasonable safety to life in school buildings. The code recommendations are based upon the opinion that the material of building construction, while important, is less significant than factors of design and arrangement. A building can be constructed of "fireproof" materials and still present a severe life hazard if open stairways permit the rapid spread of fire and smoke, and if the combustible contents are not properly protected. The hazard of smoke may be more important

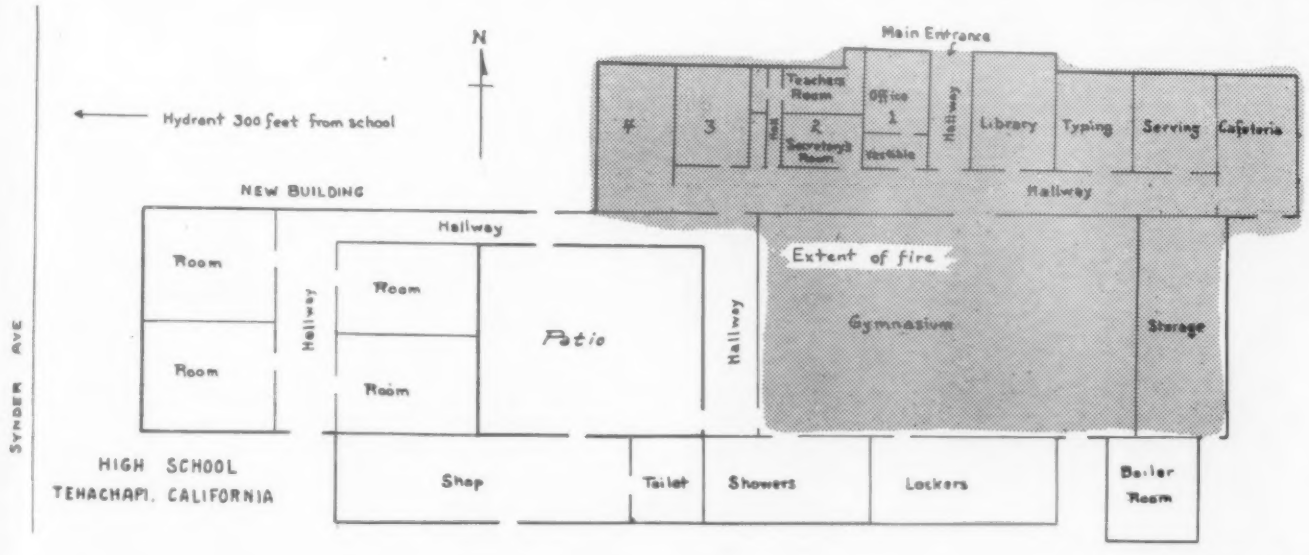
than that of fire itself, as more fire deaths are due to effects of smoke than actual burns, and even a light amount of smoke may cause a fatal panic.

Engineers' Advice Would Cut Down Losses

Now assuming that life safety factors have been attended to, we might consider why so many school fires result in large losses. One of the most important factors, and one that is frequently overlooked, is the location of the school buildings. Schools are customarily placed in residential areas close to the homes of the children. Schools are frequently the largest and most valuable buildings located outside of the business and manufacturing districts of the community. Fire protection facilities such as apparatus, fire department personnel, water mains, and hydrant distribution, which are adequate for residential properties, are seldom adequate to control a school fire which has passed the most incipient stage. Many fire reports received by the National Fire Protection Association indicate that modern school buildings have been destroyed because the four- and six-inch water mains frequently found on residential streets were utterly inadequate for fighting a school fire. Fire companies in residential districts are usually lightly manned, and although additional forces may be mobilized for fires in schools, such help frequently does not arrive before the fire has spread beyond control. These facts indicate the need for internal fire protection in the school building that will be adequate to keep any small fire under control.

Another major factor in the extensive school fire losses so frequently reported, is that good fire protection engineering advice has not been obtained before a proposed school building design has been approved. Many of the school buildings considered most modern in other regards are "built to burn." Perhaps a typical case will indicate the apparent trend. A small residential suburb votes to build a $250,000 high school. A two-story brick walled structure is erected, and the taxpayers assume they have a modern building of fire-resistive design because they see no combustible trim in the stairways and interior corridors. Such is not the case, however. An open wooden attic extends over the entire length of the building. Heating and ventilating ducts from all parts of the building terminate under this forest of wooden joists which soon become tinder dry. A very small fire starting in any room of the building will cause heat to quickly reach the attic space, perhaps aided by ventilating fans and lack of dampers in the ducts, and even with the most favorable circumstances the fire department could not be expected to prevent a nearly total loss to the building. Once fire has gained headway in this inaccessible roof space it will be almost impossible for fire fighters to remain inside the building. No adequate means for attacking a fire in the roof area from the outside have been provided. To add to the hazards in this typical modern school there is a large supply room on the top floor segregated from the roof space by an incomplete wooden partition. In this storage area have been found an electric extension light supported by nails and oily rags used to clean guns and other equipment belonging to the local State Guard company.

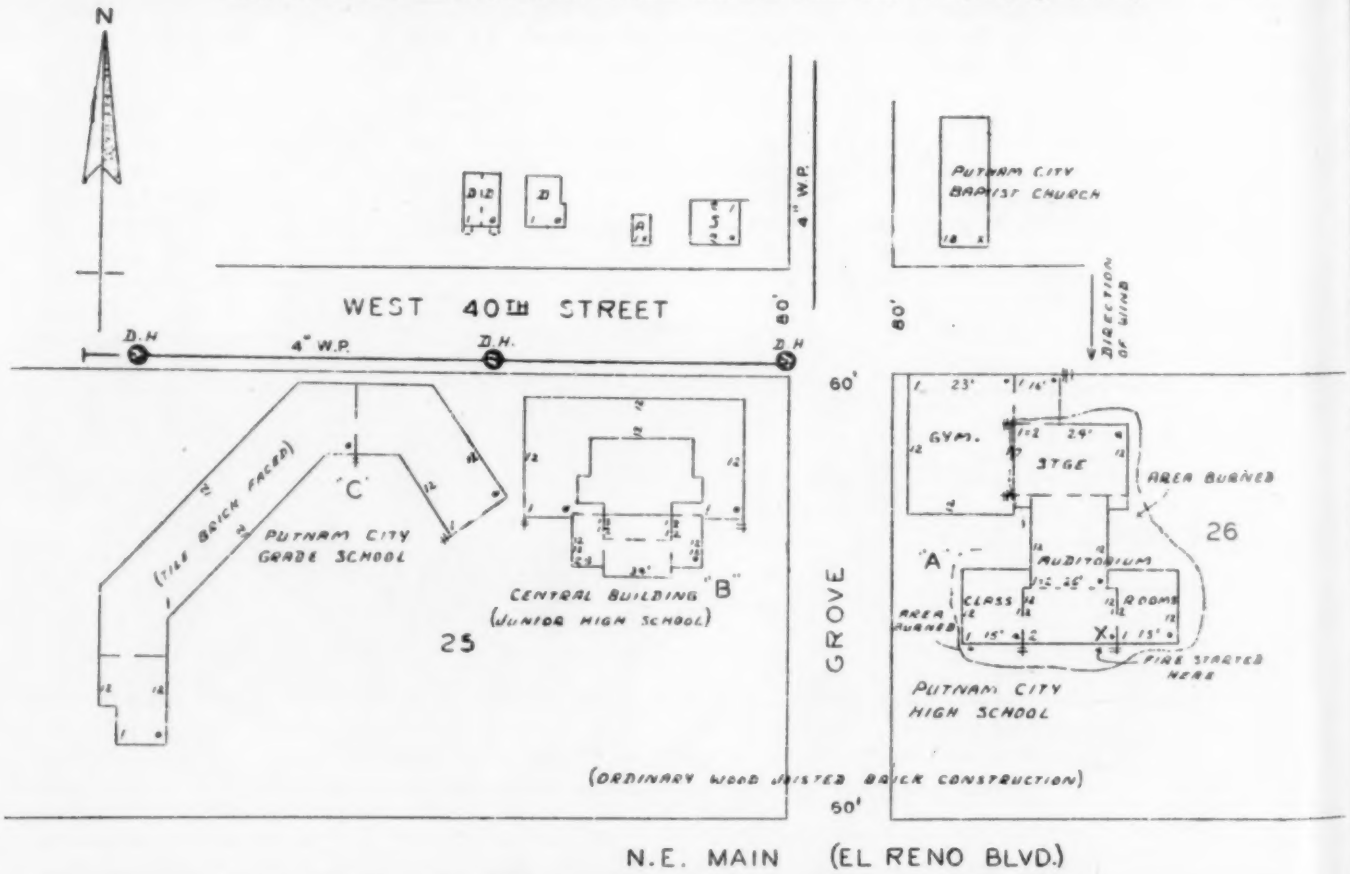
Apparently, when the new school was built the local fire department was consulted as to the fire protection that should be furnished. The result happened to be the installation of a manual fire alarm box on the exterior of the building. This box may be actuated by auxiliary manual stations located in the corridors. While we do not wish to minimize the importance of prompt transmission of fire alarms, it is only fair to state that manually operated fire alarm equipment of itself does not provide adequate fire protection. No doubt, in making such a recommendation, the fire department visualized a hair-raising dash to the blazing school just in time to snatch the imperiled children from the fast spreading flames. Actually, however, the



Courtesy Volunteer Firemen

A fire chief and volunteer firemen managed to confine damage to the west end of the high school, although the fire had been burning for about five hours when discovered. Despite a loss of $74,010 out of a value of $121,000, the City Council is considered lucky since the total amount of water available was insufficient for a good stream. This could have been corrected, but when materials were available, the council was reluctant to spend the money

Hampstead, New Hampshire, firemen reportedly had this early morning blaze in the Central Grammar School across the street from their fire station under control when the water hole from which they were pumping went dry



Putnam City (Okla.) fire resulting from a defective gas-steam radiator. Classroom, auditorium, and stage of the high school were totally destroyed. The fire department was seriously handicapped because of the inadequate supply of water obtainable only through a long 4-inch dead end main. By the time hose was connected to another main 3060 feet away only the gym could be saved.

community has a volunteer department with no paid fireman on duty, and if a fire does occur it usually takes from eight to ten minutes for the apparatus to arrive—providing someone is on hand to give an alarm. That such a situation is not unusual is borne out by the fire records of the National Fire Protection Association documenting the destruction of many such school buildings.

Automatic Sprinklers Put Fires Out

This brings us to the one satisfactory solution for the problem of school fire safety which is operative at all times day or night—whether the building is occupied or not. This is the provision of an automatic sprinkler system. This should preferably be a complete sprinkler installation protecting all portions of the building, but even a partial system covering hazardous areas such as basements, boiler rooms, shops, and laboratories, and protecting halls and stairways through which the children must pass when evacuating the building, will prove a most sound investment in safety.

A typical instance of automatic sprinkler operation in a school building was recently reported by Fire Marshal Denis Lahey of Waterbury, Conn. A fire in the basement of the Bishop school, which might otherwise have gone undetected until far out of control, was extinguished by the operation of one sprinkler head before the arrival of firemen summoned by persons who heard the sprinkler alarm. This is not as dramatic a story as a three-alarm fire in a school building, but it was a much more satisfactory outcome from the point of view of school department officials.

The National Fire Protection Association has maintained careful records of the performance of automatic sprinkler systems at fires for a period of 50 years. In educational properties over a long period, automatic sprinkler equipments show an almost perfect record of performance. Out of 110 fires in educational buildings in which sprinkler protection was a factor, 103 fires were controlled by the sprinklers. This is an efficiency record of 93.7 per cent. Of the seven cases classed as unsatisfactory by the N.F.P.A., three occurred in unsprinklered sections of schools having only partial sprinkler protection; one occurred in a small unheated room where sprinklers had been shut off for the winter; in two fires sprinklers were shut off in an unauthorized manner, once by an arsonist and once by a watchman. The remaining instance of unsatisfactory sprinkler operation was a night fire in an isolated rural school. Sprinklers held the fire in check for some time, but due to delayed discovery of the fire, the limited water supplies provided were used up before the fire was brought under control.

Depreciation Due to Ignorance of Facts

Now, what are some of the reasons why school officials, as a whole, have overlooked the importance of automatic sprinkler protection, whereas, important business and industrial properties could never function economically without this protection? There are doubtless a number of reasons. Probably, foremost, is the mistaken idea that any building with brick exterior walls is "fireproof" regardless of the unseen forest of timber behind partition walls and in the floors and attic. Then, many fire department officials who may be called upon to advise in such matters still secretly prefer the thrill of fighting a fire by manual means rather than of rolling up to a school with sirens shrieking only to find that sprinklers have put the fire out.

In many other cases, advice in matters of school fire safety is not sought from fire officials but from a local insurance agent who is merely an insurance salesman without experience qualifying him to make recommendations in matters of fire protection engineering. As a matter of fact, many insurance salesmen would be reluctant to recommend automatic sprinklers. Sprinklers frequently result in a drastic reduction in insurance rates on the building, with a consequent marked reduction in insurance agents' commissions. In most communities, local insurance agents share in the premium income on public buildings insured against fire and cannot be expected to push recommendations that will make a sharp reduction in this income.

On the other hand, in instances where to give life safety and to cover the chief hazards only partial sprinkler protection of a school building is contemplated, the insurance saving alone cannot be expected to cover a substantial portion of the cost of the added protection, as is the case in so many manufacturing properties. Thus one of the "sales arguments" in favor of sprinklers is lost unless the responsible persons are more interested in life safety than in monetary return for their investment.

Perhaps the greatest reason why automatic sprinklers have not been a "must" item in every school is that school officials themselves have not been ade-

Automatic sprinklers proved their value when they opened and held in check this school fire in Providence, R. I., until arrival of the fire department

There was no sprinkler system in this school

quately informed regarding the function of these systems. There are undue fears that sprinklers may cause needless water damage in the event of a small fire. Of course, a sprinkler head will discharge 10 to 15 gallons of water per minute providing there is heat enough under it to melt the fusible element. A fire department hose stream throws an average of 250 gallons—one ton of water a minute, and much of this may be thrown into smoke and never reach the flames.

The fact that automatic sprinklers put out the fire in an incipient stage rather than until an extensive fire is in progress, as is often the case with hose streams, is an advantage in favor of the sprinklers. Where a sprinkler system is provided in a school in an isolated location, it is desirable to have a sprinkler alarm connection reporting directly to the fire department or other proper supervisory station. This would supplement the usual local sprinkler alarm bell or gong on the premises and bring the benefits of an automatic fire alarm system along with the other advantages of sprinkler protection.

An interesting illustrated folder explaining the importance of automatic sprinklers for school fire safety is available on request to the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

Causes of Fires Summarized

Fire hazards and processes to be guarded against in schools, according to the Handbook of the National Fire Protection Association, are: *electrical*—defective wiring, short circuits, appliances overheated or left on; *spontaneous ignition*—rubbish accumulations, chemicals; *smoking, matches*—primarily in dormitories; *heating*—defective equipment, flues, chimneys, overheating; *incendiarism*—children; *other*—chemical and physical laboratories, manual training and domestic science departments, motion picture film, wooden shingle roofs, heating and ventilating ducts, frequently combustible construction and inadequate fire protection.

According to the same authority, chief life safety requirements are adequate exits, protected vertical openings, alarm facilities, automatic sprinklers, fire drills.

The fire record emphasizes that most school fires are due to well-known and easily prevented common hazards. Causes are as follows: *electrical*—16% of total known causes; *smoking, matches*—12%; *incendiary*—11%; *defective or overheated heating equipment*—11%; *spontaneous ignition*—11%; *ignition of flammable liquids and gases*—8%; *defective or overheated chimney and flue*—7%; *sparks on wooden shingle roofs*—5%; *rubbish*—5%; *sparks from stoves*—3%; *chemicals*—2%; *lightning*—2%, and *miscellaneous known causes*—7%.

The one leading cause, that fire protection engineers might term a "special hazard" in schools, is the comparatively high percentage of fires due to incendiarism by little "brats" who do not love their teachers or their Alma Mater. While this problem is serious because such malicious fires result in greater than average damage, this is a problem of juvenile delinquency that deserves the attention of psychiatrists and school officials rather than of fire protection experts.

MAINTAINING SCHOOL EQUIPMENT IN USABLE CONDITION

By B. S. CORBITT

Business Manager, Davidson County Schools, Nashville, Tenn.

METHODS of maintenance of equipment in usable condition are best exemplified in the time-worn adage which has been handed down through generations—"An ounce of prevention is worth a pound of cure"—or—"A stitch in time saves nine." We are apt because of the familiarity of these two phrases to lose the full significance of their meaning. Too long have instructors and students considered school equipment, in the one case, as a convenience in making a living, and in the other, as a personal service; regard for its continued use by and service to others who may follow has been lacking. We say this because we feel that "preventive maintenance" is far more important than "corrective maintenance."

The thought of maintenance comes into the picture simultaneously with the thought of purchase. The individual who makes a purchase for personal use carefully weighs make, performance, and construction of the article to be bought. The same considerations apply to the purchase of school equipment. Carefully kept records of comparative service and maintenance are imperative. In normal times, the field of school equipment is large and competitive, and this necessitates careful consideration of past performance, adaptability to the immediate need, the durability of construction. To requisition even one microscope without reference to specifications is just as foolish as to requisition an automobile without reference to specifications. Moreover, maintenance begins when an item of equipment is installed in the classroom, even before the item is put into its first use.

Maintenance Begins with Instructor and Students

The first responsibility of maintenance falls on the instructor in whose department the article is to be placed and under whose supervision it is to be used. It is mandatory upon him to acquaint himself thoroughly with construction, use, and adjustment of each piece of equipment. Consider, for example, such a commonplace item in the classroom as the student's seat. Is it unreasonable to ask that the instructor know and understand the construction of as simple a thing as a classroom seat? Obviously each type of seating is bought and placed in the classroom for a particular reason and can be adjusted to serve the purpose of that particular classroom. We think that continued use and maximum efficiency are primarily dependent upon the instructor's knowledge of the mechanics of the equipment.

We must insist that any course of instruction begin with a thorough teaching of the proper handling of the equipment to be used by the students, not only to obtain better results, but also to lessen the likelihood of defects caused by improper use. What better education can we offer than a knowledge of the tools through which we reach our objective? Furthermore, a consciousness of individual responsibility will lead each student to keep a watchful eye upon the equipment.

When we begin to talk about the care of equipment, there comes to our minds the many thousands of uncovered typewriters we have seen in our visits to the schools at the close of the school day. Evidently such responsibility is left to the custodian or to no one at all. Many of our maintenance problems might be dispensed with if students were taught to observe factory regulations and recommendations for storing of equipment when not in use. This is especially true of equipment in our vocational shops and science laboratories. Upon the willingness of the instructor to acquaint himself with the make-up and the care of the tools with which he bridges the valley from the unknown to the known, and to instruct the pupil accordingly, depends the amount of corrective maintenance necessary to keep those tools in operation.

Corrective Maintenance Has Two Categories

Actual corrective maintenance of school equipment automatically divides itself into two phases: one, machines that require maintenance by factory mechanics, and two, equipment that can be handled by a well organized and directed school maintenance department.

In the first category is such equipment as typewriters, adding machines, calculators, much vocational equipment, and musical instruments. We have found in our years of association with the department of education that an out-and-out yearly contract, let on base specifications as to times of inspection, type of inspection, responsibility for replacement of broken parts, and periods of payments on contract, to be the best way of assuring continuous service from this type of equipment. For instance, in the case of commercial department equipment such as adding machines, calculators, mimeographs, and checkwriters, a base contract calling for general cleaning, overhauling, and replacement of worn and broken parts and supplying needed covers at a period just prior to the opening of the school term, and specifying quick response to service calls throughout the year at a flat charge per machine per year, seems to be an ideal contract.

The arrangement of payment for the contract in installments—the first falling due at the completion of the initial cleanup and reconditioning of the machines, the second falling due at the beginning of the second semester, and the final payment falling due at the close of the school year—assures the continuance of the contract and prompt service on the part of the agent taking the contract. We find that most branch dealers prefer this type of contract to insure the

proper operation of their particular make of equipment.

The answer to maintenance of school equipment in the second category is found in the operation of a maintenance department supervised by a skilled mechanic who has a working knowledge of all of the mechanical trades. We admit that it is hard to find these qualifications in one person, but it is not impossible. The supervisor should have full authority over the work of the men under him and should be answerable only to the superintendent of schools and the board of education. He should have full control over the selection of mechanics for his department. He should have a sufficient knowledge of organization to work in harmony with the departments of administration in the individual schools.

Defective Equipment Should Not Be Tolerated

The maintenance of general school equipment should dovetail into the maintenance of school buildings. When a building is painted on the outside and inside, all standard equipment in the building should be inspected, defects corrected, cleaned, and refinished. This procedure, and minor repairs and adjustments by a custodian who is to some degree efficient, should keep the major part of the school equipment in usable condition. In no case should the continued use of imperfectly operating equipment be allowed. Both the longevity of the equipment and the correct instruction of the student demand that "out-of-use" periods be established for all equipment showing defects that call for the services of a skilled mechanic. "Patch-up" practices on the part of instructors, students, or custodians should in no instances be tolerated.

Equipment which has reached the state at which repairing and reconditioning are impracticable should be thoroughly salvaged and usable parts stocked and cataloged before junking. This makes it possible to save many pieces of equipment for which it would otherwise be impossible to get parts. This calls to our mind the necessity of a well-stocked parts department in connection with the maintenance department; a warehouse of ample size to store idle equipment in good condition; a cabinet shop; a plumber's shop; an electrical shop; in fact, as we have said before, personnel, tools, and supplies necessary for the operation of each trade should be represented in the maintenance department.

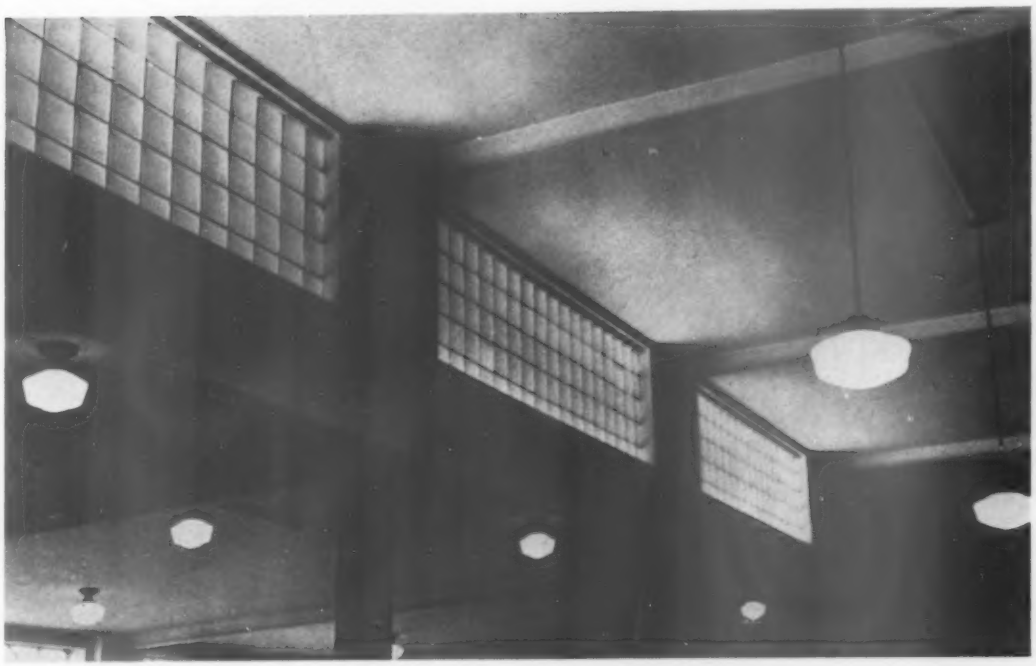
School equipment is made to be used. The continued presence of a piece of broken and unusable equipment in a school building casts reflection on the administration of any educational system and is a far worse influence on the attitude of the student than no equipment at all. Make the care and preservation of school equipment a part of education itself, treat corrective maintenance seriously and effectively, and the life and service of instructional equipment can be extended indefinitely.

Courtesy Board of Education, Rochester, N. Y.

Above—As a preventive maintenance measure, typewriters should be covered by students at end of day

Right—Corrective maintenance calls for immediate repair of major defects by skilled mechanics; for immediate adjustment of minor repairs by trained custodian

One wartime achievement was to replace the steel sash windows in the main administration office with glass brick. The attractive glass brick is liked because it deflects the direct rays of the sun, furnishes insulation, keeps dust and moisture out



MAINTENANCE IN WARTIME

By F. J. DU FRAIN, Assistant Superintendent and Treasurer
and D. E. MC GRATH, Superintendent of Buildings and Grounds
Board of Education, Pontiac, Mich.

IN times like these, when there is a scarcity of critical materials, those of us who are in charge of the operation and maintenance of school plants are challenged to muster all of our ingenuity to keep equipment functioning to its limit. What we have been able to accomplish in Pontiac, Michigan, is the subject of this article.

Clean-up Yields Choice "Finds"

It was with great delight that we were able to "clean house" in some school buildings, using the salvage campaign as a pretext. In the school attics and storage rooms, always assumed to be their private domain, the principals had stored their favorite mottoes, May poles, costumes, spinning wheels, and extra furniture. What junk! What fire hazards! Much of the material rated the city dump, but there were also choice "finds." These included a quantity of school furniture that was usable and some that was repairable; other furniture which could be disassembled and the resulting oak, maple, and birch boards added to the carpenters' stock of repair parts. Last, but not least, considerable scrap was made available for the war effort.

Furniture to Specification

Our schools use the two-student type of table with chairs, in addition to some of the old fixed-seat type of furniture and a great many of the universal movable-seat type. After the manufacturers stopped making steel movable furniture, local planing mills turned out hundreds of student tables of wood to our specifications, and the tables were finished—sanded, sealed, and waxed—by our maintenance men.

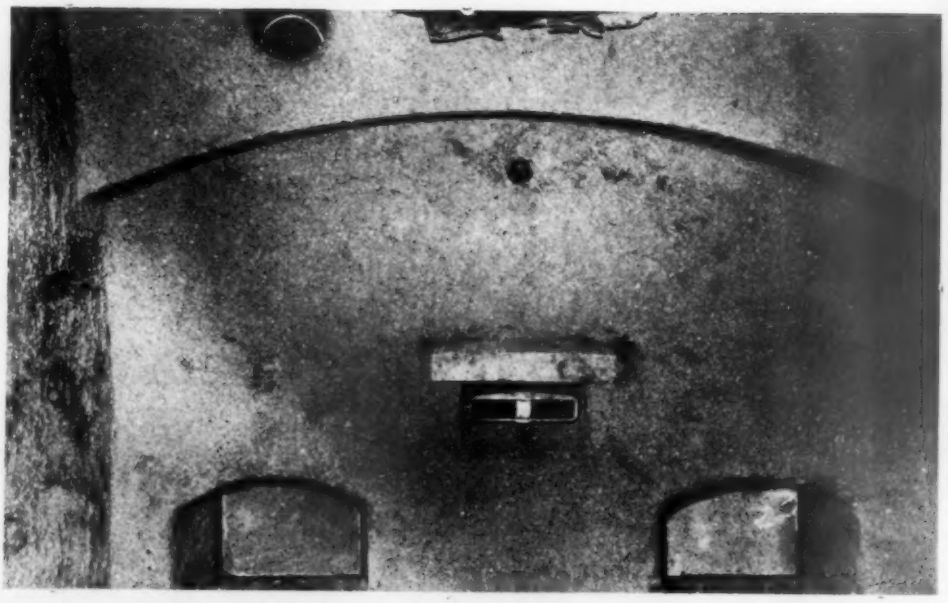
Tables slated for elementary rooms are made with drawers for two students; those for the junior high schools come without drawers.

As sets of table legs had been previously stored up, only a small expenditure of labor was needed to adjust the furniture to 22, 24, or 27-inch heights to suit the requirements of different age groups.

New linoleum-top furniture is not available. How-

Baldwin School, H.R.T. Boiler Repair

Firebox with brick removed back to the bridge wall, ready for plastic refractory lining. Note evidence of soot and leakage through the old firebrick on to the common brick and the breakage of headers, cracks, etc.



Plastic refractory front and arch complete. Note doors, wet down pits, pneumatic spreader nozzle in center, and hot gas outlet for stoker in upper left-hand corner

Looking forward, showing bridge wall. Plastic refractory firebox finished and ready for fire. Note refractory anchors showing in sidewall. Has been in use three years without repairs

ever, local dealers are replacing old linoleum tops. They also are putting linoleum tops on new tables after our carpenters affix the edging strips.

Our Office Is Fixed Up

Our administration headquarters was formerly a factory. Replacing the steel sash windows in the main office with glass brick was a boon. The glass brick deflects the direct rays of the sun—for which the girls in the office are particularly thankful, keeps dust and moisture out, adds insulation, and improves the appearance of the office.

Treating the ceiling in the same building with acoustic tile increased the usefulness of the rooms, furnishing additional insulation both in winter and in summer, and improved the general appearance.

Many Jobs Claim Attention

A few other instances of our efforts to improve conditions without benefit of critical materials are:

Replacement of wood floors on ground levels with concrete and asphalt tile

Repairing of concrete floors and sidewalks

Pointing of exterior brickwork and copings

Caulking of window and door frames

Repairing and extension of clay tile and concrete drains

Repairing of playgrounds and the filling of chronic depressions under swings and equipment with road gravel (which packs much harder than cinders or like materials)

Better care of landscape plantings, lawns, shrubbery, and flower bed; trimming and feeding of trees (with surprising results), and new planting

Repairing of fences and painting of them, if possible (a use for stub brushes here)

Repairing of furniture with rough-sawn oak, other small mill products surfaced in our own shops, and panels of gypsum board or other non-critical wall boards (three badly-wrecked chairs may yield parts for one good one)

Repairing of boiler settings and relining with plastic firebrick to give years of trouble-free service and to help conserve coal

Repairing of leaky channeled radiator nipples and the substitution, where necessary, of cast-iron nipples, both machined and threaded, which are available and not too critical now

Inspection and repair of traps of steam-heating systems. Repair parts for standard-make traps or replacement units are available in limited quantities on the MRO priority

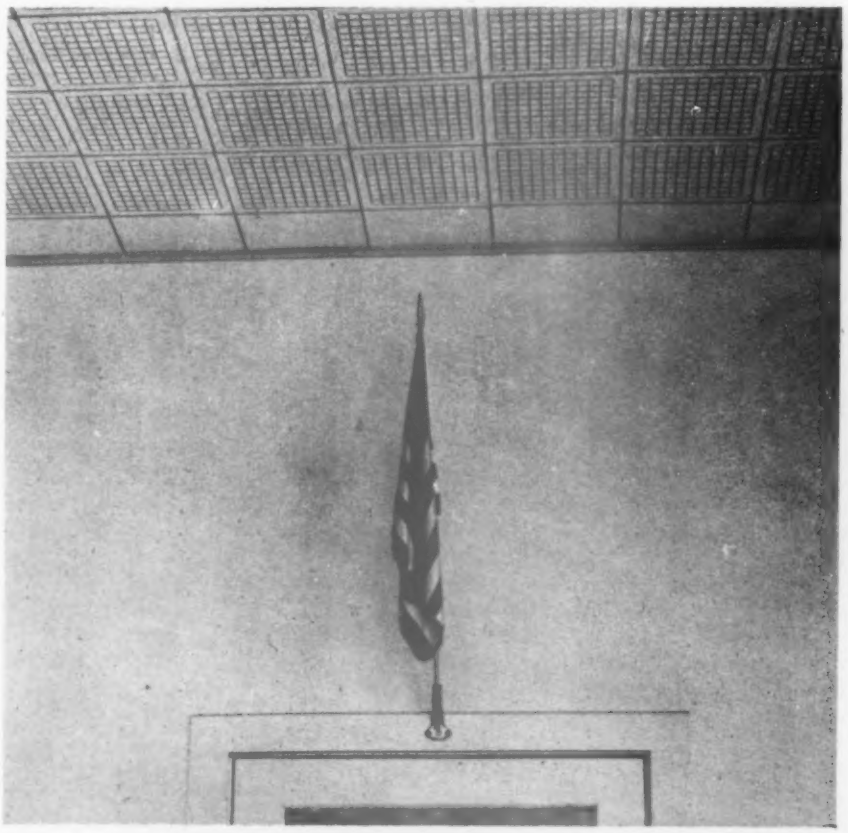
Cleaning of vacuum pump tanks and hot-water tanks for the sake of efficiency

Cleaning of heating fan blades and ducts (one-eighth inch accumulation of dirt on the curved blades of a fan will cut its efficiency 20 per cent)

Vacuum cleaning of attic spaces and plenum chambers of heating systems

As a last word, our experience has taught us that ingenuity, patience, planning, and elbow grease pay great dividends in satisfaction, appearance, and results; that preventive maintenance, a critical need, can be used in unlimited amounts. Comprehensive postwar plans should be in the making—they need no scarce materials.

EDITORS' NOTE: This article is reprinted from our associate publication, THE SCHOOL EXECUTIVE for March, 1945.



The ceiling of administration headquarters was treated with acoustic tile. Improved adhesives simplified application of tile

". . . it is advisable to make provision on the first floor for loading and unloading trucks"

STOREROOM MANAGEMENT

By W. E. STRICKLER

Superintendent of Supplies, The Board of Public Education, Pittsburgh, Pa.

IN the small school district, which has only one or very few school buildings, storeroom management presents not many problems. There are some fundamental rules which should be observed even in the smaller districts, however. In every school building there should be a central storeroom where supplies are stored when received and stock kept in neat and orderly fashion, so that any item can be found when wanted. Teachers should be required to make out requisitions at regular intervals, and records should be kept of the quantity of each item on hand and of the amounts given out to teachers.

In medium-size districts, which have say 10 to 20 buildings, the problem of whether to maintain a central storeroom for the whole district presents itself. On the one hand, the central storeroom results in lower prices because it permits delivery of larger quantities to one location; it makes possible better inspection of materials to ascertain whether the article complies with the purchase specifications; it lessens the possibility of overstocking at one school because a more careful inventory check is usually kept and smaller quantities are distributed at a time. On the other hand, the expense of maintaining a central storeroom must be taken into consideration: storage space, light, heat, insurance, the services of a storekeeper, maintenance of a truck for distribution, and keeping of inventory records will all have to be provided for. Only after weighing the advantages against the disadvantages can a wise decision be reached.

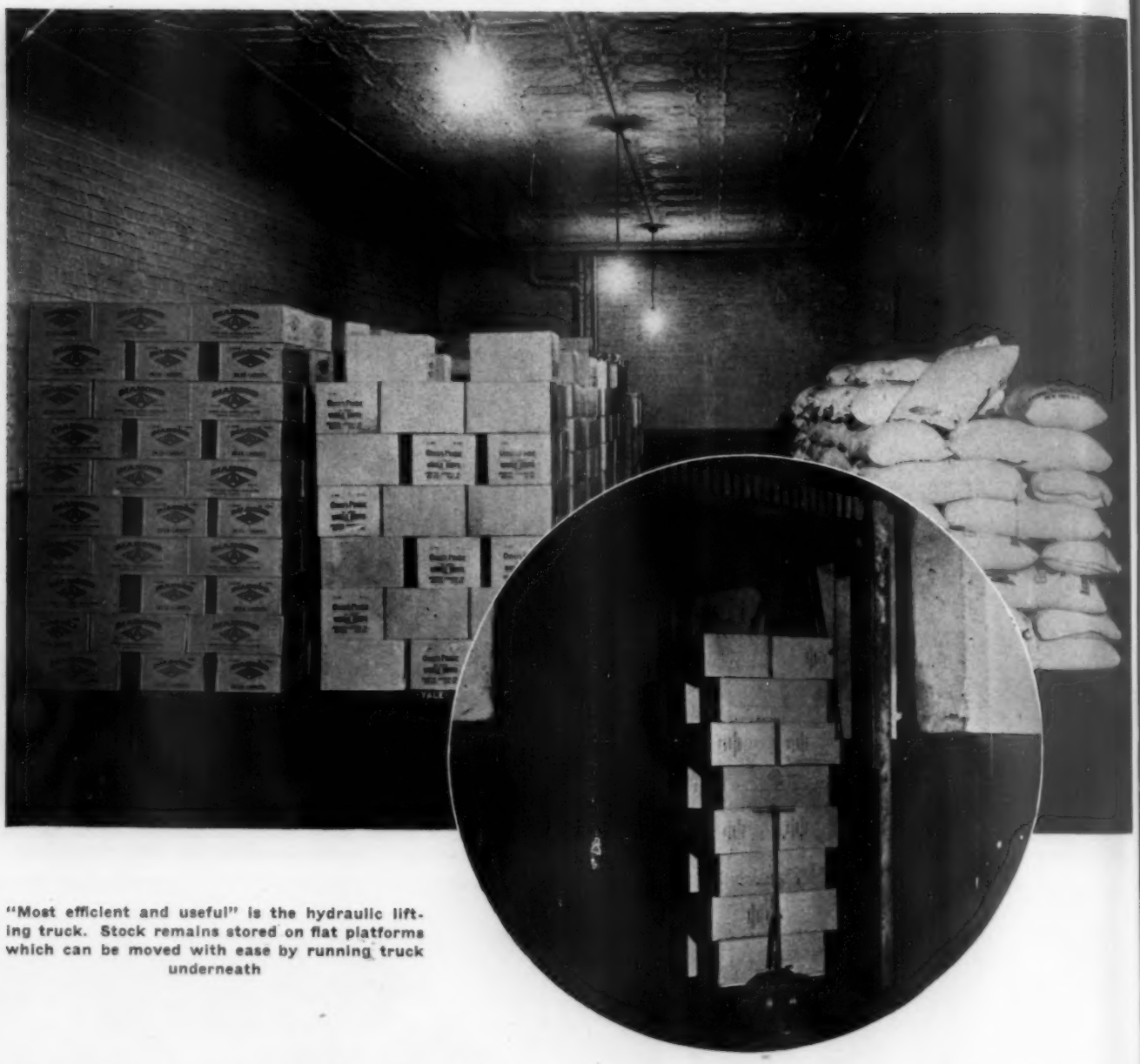
In the large districts, the necessity for a central storeroom is a foregone conclusion. The problem here is how to manage the storeroom so as to render the best possible service to the schools at the lowest cost.

What Kind of Building Suits the Purpose?

The location and type of building to be used as a storeroom will depend largely upon local conditions. In Pittsburgh during the past 30 years, we have had our stock in three different buildings, two of which are owned by the board of education, but not one of which was designed and built for our purpose. At the present time, our main storeroom and the repair shop are housed in a four-story building located quite near our administration building. Our furniture repair shop is in an abandoned school building in another part of the city, while our staple groceries for school lunchrooms, as well as some furniture items, are kept in another warehouse. Our visualization library is in still another school building. It is quite evident that these conditions are not ideal and result in a considerable amount of handling and hauling. It is our hope that sometime in the not too far distant future we will erect a building to house all of these facilities under one roof.

A building planned for storeroom purposes should provide adequate space for all needs but avoid superfluous areas because unused space is a waste. If at all possible, it is advisable to make provision on the first floor for loading and unloading trucks and all materials that are heavy or are constantly moving in and out. Shops that do not use much heavy material

A well-run storeroom is clean and orderly. "When new stock is received, it should be promptly checked and put in its proper place; care should be exercised to keep the older stock to the front . . ." Requisitions should be filled promptly



"Most efficient and useful" is the hydraulic lifting truck. Stock remains stored on flat platforms which can be moved with ease by running truck underneath

could be located on the second floor. If elevators are necessary, more than one should be provided, but otherwise ramps are more satisfactory. If the building is located on a sloping lot, it may be possible to have loading and unloading facilities at ground level from two floors on opposite sides of the building. Sometimes a mechanical conveyor can be used to advantage. Necessities are housing for the delivery trucks, an underground gasoline tank and pump, and facilities for washing, greasing, and servicing the trucks.

What Are Equipment Essentials?

Nothing contributes more to the economy and efficiency of a storeroom than proper equipment, both fixed and movable. For the storage of items which must be kept on shelves or in bins, steel shelving is the most satisfactory; it can be obtained in flexible units which can be arranged to suit the available space. Steel racks are made for pipe, rods, and angle iron. A revolving rack, which comes in various sizes with large or small compartments, is convenient for storing small articles when space is limited. These rotary racks or bins are particularly useful for storing small quantities of each of a number of sizes of items such as rivets, screws, and stove bolts.

Since weight is an important factor in both receiving and dispensing many of the items used in our schools, it is important that the storeroom be equipped with sturdy, accurate scales. There should be a platform scale for the heavier materials and counter scales for the smaller items. Scales should be tested regularly to insure accuracy.

Every storeroom must have trucks, and there are many different kinds and sizes to be had. The most efficient and useful truck is the hydraulic lifting type, used in conjunction with flat platforms. These platforms, which can be used for storing large quantities of items such as paper goods, can be moved about with ease by simply running a truck under the plat-

form. Once a platform is loaded, the stock remains on it with no further handling, thus saving considerable labor. While rather expensive, one truck of this type, with sufficient platforms, is worth more to a storekeeper than a number of the old style platform trucks on wheels.

The use of conveyors depends largely upon the conditions in any particular storeroom. Gravity conveyors can be installed at reasonable cost and can be used to advantage in many storerooms. I have never had personal experience with conveyors of any type; the only one we have is a so-called "dumb waiter" which is used many times a day for small packages.

It should hardly be necessary to mention the importance of cleanliness and orderliness in the storeroom. When new stock is received, it should be promptly checked and put in its proper place; care should be exercised to keep the older stock to the front so that it will be used first. This is particularly important with items, such as paper, which deteriorate with age.

What Are Record-Keeping Essentials?

Proper storeroom records are as essential as care of the stock. The most important, the perpetual inventory, or stores ledger as it is sometimes called, is usually kept on cards, with a separate card for each item carried in stock. The card shows the receipts and disbursements of the item, with the balance on hand, and date, order number, quantity ordered, and price of each order that is placed with a vendor. When the vendor's invoice has been approved, the price should be verified on the inventory card, so that the card carries a record of the actual price paid.

Consumption Record

A consumption record, made up from the information on the inventory card and showing, after a number of years, the increase or decrease in the use of each item, is of great help when ordering stock. In industrial storerooms, a minimum and a maximum are usually placed on each item, and when the stock reaches the minimum, the storekeeper orders enough to bring it up to the maximum. This method is satisfactory for a storeroom which fills requisitions throughout the year; in many school systems, however, supplies are distributed from the storeroom to the schools only once a year or perhaps once a semester, and in these cases, the maximum and minimum practice may not work satisfactorily. Orders for large quantities must be placed well in advance of the time of distribution, and the consumption record can serve as a guide.

Requisitions should be filled as promptly as possible after they are received, and great care should be taken to avoid errors. Entries on the perpetual inventory record of materials taken from stock should be made either before or immediately after the requisition is filled.

Back Orders

In a storeroom which handles a large number of items, some things are almost sure to be out of stock when needed—which brings up the subject of back orders. It is best not to hold the entire requisition until all the items can be supplied, but to write a back order for the items that are short and to fill the back order when the material comes in. It should be the aim of all those who are engaged in the operation of a storeroom to keep the number of back orders to a minimum. The first responsibility rests on those in charge of the perpetual inventory records; they should notify the purchasing office as soon as the record shows that the stock of any item is low. It should be the duty of those actually filling requisitions, when they see that the stock of any item is low, to check with the inventory clerk to see if a new supply has been ordered.

Inventory

As to physical inventory, there are some authorities who claim that with a good perpetual inventory system, a physical count is unnecessary; however, merchandise in stock represents cash; as a banker would not think of depending upon his books to show the amount on hand without an actual count of the money, so the alert storekeeper should at least once each year check his actual stock with his inventory record. It may not be necessary to suspend operations and take the entire inventory at one time; the inventory can be made by counting groups of items at different times. Every item should be checked once annually: since no inventory system is perfect, errors are bound to creep in; frequent checks reveal discrepancies that may exist and often make it possible to discover where and how the mistake was made.

As soon as material is delivered to the storeroom, a record should be entered of the number of boxes, barrels, cartons, etc., received, with name of shipper, how and when delivered, and the order number if shown on the shipment. The packages should be opened as soon as possible and a careful check made of the contents; to aid in this, the storekeeper should have a copy of the purchase order. At the same time, the material should be inspected by someone who is competent to determine whether or not the quality complies with the specifications. After this, the material can be put away, placed so that the older stock will be used first. The purchasing office should be notified promptly of the receipt of material whether or not the supplies received are strictly in accordance with the purchase order.

Good Management Has Two Aims

I have endeavored to outline briefly some of the things that contribute to good management in a storeroom. Much more could be written on the subject, but these requisites should be kept in mind:

1. A good building, suited to its purpose.
2. Adequate equipment, both fixed and movable.
3. Clean and orderly arrangement of stock, so that any item can be located without delay.
4. Carefully kept records of materials received, disbursed, and balance on hand.

Those of us who are engaged in the business of keeping our schools supplied are ever conscious of these two desires; first, to make our contribution to the education of our boys and girls by always having available for their use and for the use of their teachers, the necessary books, supplies and equipment; and second, to provide these services at the lowest possible cost.

ADVANCE MACHINE COMPANY

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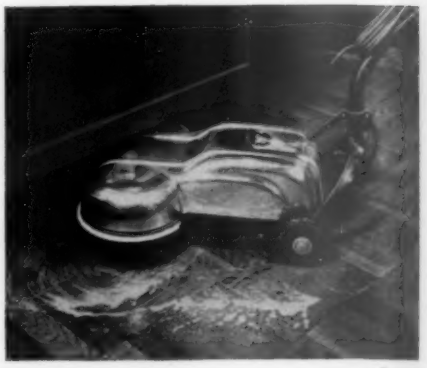
One Machine SCRUBS — STEEL WOOLS — WAXES or POLISHES All Types of Floors

For rapid, profitable maintenance work on all kinds of floors—investigate what Advance has to offer you. For quiet, vibrationless operation —you'll find them unexcelled. The "Lowboy" design saves time and work and makes it easy to clean well in all the corners and under equipment. Hundreds of schools have for years profited by Advance dependability. (Names on request.)



ADVANCE "Lowboy" is built low enough to get under desks easily

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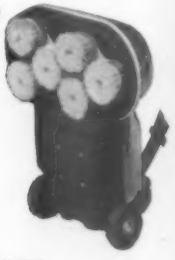
Its speed, quietness, thoroughness and long life make it the ideal machine for school use

LOWBOY 12—¼ H.P. Motor. Brush spread 12"—brush speed 320 R.P.M. Single brush, 3 segments. Height over brushes, 5¾". Silent V-Belt drive. ADVANCE patented brush holder makes brush changing quick and easy. Both scrubbing and polishing brushes included. Also 12 H. with ⅓ H.P. 2½ gal. automatic dispensing tank extra.

LOWBOY 15—⅓ H.P. Motor. Brush spread 15"—brush speed 320 R.P.M. Single brush, 4 segments. Height over brushes, 5¾". Also 15 H. with ½ H.P.

LOWBOY 16—⅓ H.P. Heavy Duty Ball Bearing Motor. Brush spread 16"—brush speed 375 R.P.M. Twin brushes, 3 segments each. Height over brushes, 6¼". Opposite rotation assures perfect balance—no side pull. Spiral worm gear drive. Same equipment as above. A splendid machine for all general utility use.

LOWBOY 21—½ H.P. Heavy Duty Ball Bearing Motor. Brush spread 21"—brush speed 275 R.P.M. Height over brushes, 7¼". Same design and equipment as Lowboy 16. LOWBOY 21 is recommended for large areas and heavy duty service. Built to outlast and outperform any other machine.

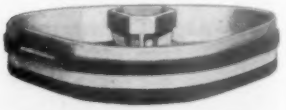


BRUSHES EASILY CHANGED

With the ADVANCE patented brush holder it takes but a moment to insert the brushes needed for the work at hand.

A BRUSH FOR EVERY PURPOSE

Brushes may be obtained in bassine, palmetto, tampico, steel wire, etc., for scrubbing, waxing, polishing, scouring, etc.



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For steel wooling, burnishing or light sanding, suitable attachments can be furnished.

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LOHSEAL · Penetrating Wood Floor Seal

Quickly and Easily Applied !

For the cellular reinforcement of wood floors. A deep-sealing, hard-drying phenolic resin seal with an exceptional resistance to wear. The ideal foundation for EV-R-Glo Wax or GYMLOH Gym Finish.

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Less Slip Hazard ——— !

GYMLOH is a tough finish: specifically designed for gymnasium floors. GYMLOH is easily applied, non-slippery, will not rubber burn, and is resistant to dilute acids and alcohol.

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For **SAFE** *Use On All Floors!*

SOIL-Solv combines the best qualities of liquid soap and synthetic cleaner to provide quicker cleansing, more complete and faster-rinsing. SOIL-Solv may be used with safety and economy on all types of floors, walls, and woodwork.

EV-*R*-Glo · Self-Polishing Liquid Wax

Water and Traffic Resistant !

EV-R-Glo self-polishing liquid wax, easy to apply, quick to dry, water resistant and relatively non-slippery . . . . EVERYTHING YOU DEMAND IN A WAX! EV-R-Glo not only protects floor finishes from heavy traffic but adds a lustrous beauty as well.

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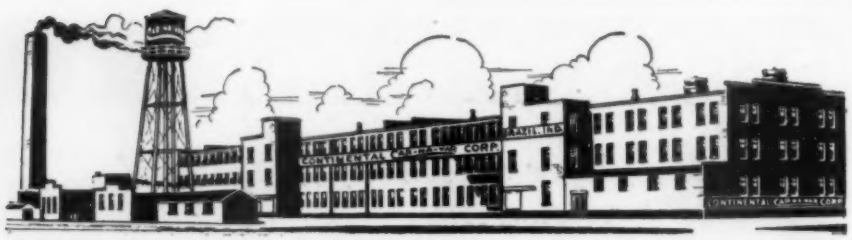
WAREHOUSES AND EXPERIENCED FLOOR MAINTENANCE ENGINEERS IN PRINCIPAL CITIES OF THE U. S. A.



World's Largest Manufacturers Specializing in FLOOR TREATMENTS FOR LARGE FLOOR AREAS IN SCHOOLS AND UNIVERSITIES

● RELIABILITY

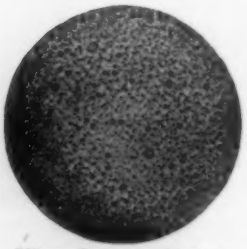
For many years we have specialized in the manufacture of floor treatments for large floor areas and are today the largest manufacturer in the world devoted to this field. For that reason we have the experience and facilities for producing the most efficient products. Balance these points against the following three classes of competitive materials . . . those primarily designed for the less severe strain of the dwelling . . . those finishes offered as mere side-lines by general manufacturers . . . and those materials made by small, inexperienced concerns with little or no responsibility.

We have many trained floor engineers in the field who service our products to see that the customer obtains maximum efficiency. Dun & Bradstreet gives us high first class rating. We are incorporated for $1,000,000. Our products are in use in many parts of the world, including the Army and Navy. They are approved by the leading manufacturers of floors and endorsed by thousands of users.

● SERVICE OFFICES

Service offices and warehouses in principal cities of the United States with an experienced floor maintenance engineer in charge of each.

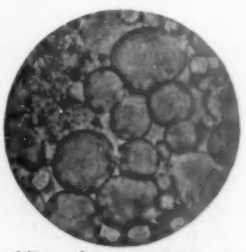
CAR-NA-VAR FLOOR TREATMENTS ARE SCIENTIFICALLY MADE



Microphotograph No. 1

Car-Na-Var Floor Treatment compounds are made of the best materials available. Despite wartime difficulties, they are still made in strict accordance with original formulae . . . **no substitutions!** In our modern factory these raw materials are tested for uniformity, blended by expert chemists, processed by special processing equipment and finally tested for uniformity of the finished product.

The special processing breaks the globules of varnish gums and waxes into minute particles as shown in Microphotograph No. 1 above. This processing insures greater covering capacity, greater penetration, greater wearing qualities, and because of perfect distribution, freedom from slipperiness. Microphotograph No. 1 shows what Car-Na-Var products look like when magnified two thousand times. Compare this with the coarse globules of wax and gums in ordinary floor treatments as shown in Microphotograph No. 2, also magnified two thousand times.



Microphotograph No. 2

Car-Na-Var products are better products because they are scientifically and accurately made.

CAR-NA-VAR — THE PERFECT FLOOR TREATMENT

MOST DURABLE FLOOR TREATMENT EVER MADE

Car-Na-Var is the original varnish-gum and wax floor treatment that combines the durability of varnish with the scratch-resisting qualities of wax. Gives a beautiful, lustrous WATERPROOF finish to all types of floors except rubber and asphalt . . . is non-slippery. Car-Na-Var requires no undercoat of sealer . . . although it is readily applied over any seal. Use Car-Na-Var if you have an electric floor machine for buffing . . . it requires more initial labor than a self-polishing wax but is much longer lasting. Applied with a mop; ready for use in an hour. Supplied in "natural" (stainless), Dark Oak, Light Oak, Walnut, Cherry, Mahogany, Maroon, Olive Green and Mission. *Meets U. S. Treasury specification for "Undercoater A" and Item 7 of proposed Federal specifications.*

CAR-NA-LAC — LACQUER-LIKE FLOOR FINISH

If you do not have a floor machine or buffer, or object to polishing, use Car-Na-Lac . . . it is "self-polishing." Radically different from all other self-polishing floor treatments! Easily applied with mop or cloth, it goes on like lacquer . . . leveling itself out to a brilliant streakless luster . . . dries like wax in less than 30 minutes. Can be used on all types of smooth, sealed or fairly non-porous floors including rubber and asphalt. Waterproof . . . non-slippery. *Meets U. S. Treasury specifications for "Finish Material" (except for percentage of solids), and Item 9, Type I of proposed Federal specifications.*

CONTINENTAL "18" — THE SUPER FLOOR FINISH

A super-finish for floors; made and applied in exactly the same way as Car-Na-Lac but contains about 38% more solid content. Designed for extra heavy duty. Recommended by a large Casualty insurance company for safety. *Meets U. S. Treasury Department specifications for "Finish Material" and Item 9, Type II of proposed Federal specifications.*

CAR-NA-SEAL
WEARS LIKE LEATHER

SPECIALLY DEVELOPED FOR GYMNASIUM FLOORS

A deep-penetrating seal for all wood floors—tough as leather and thoroughly pliable—that gives a smooth satin-like luster, free from streaks and scratches. Car-Na-Seal requires no buffing. Marks left by rubber soles (rubber burns) are easily removed. Made from Bakelite and other phenolic resins, specially processed for longer wear. Although used frequently as an undercoater for Car-Na-Lac, Continental "18" and Car-Na-Var, Car-Na-Seal is an ideal top dressing for gymnasium floors. Provides a firm, safe footing. Preserves the floor by excluding moisture and dirt from the pores . . . protects markings of basketball court, etc. Car-Na-Seal also provides an excellent finish for school desks. Average coverage 500 sq. ft. per gallon. *Meets U. S. Treasury specifications for "Sealer C" and Item 5, Type J of proposed Federal specifications.*

Two coats of Car-Na-Seal, applied once each year, keeps the 6000 sq. ft. gymnasium floor of the Highland Public School, Highland, Illinois, in tip top shape

RUBBER-VAR
FOR TREATING RUBBER FLOORS

The solvent thinners used in floor waxes and other treatments, while harmless to most floorings, are usually highly injurious to rubber and in the case of certain soft composition floors cause the colors to run. In view of this, we have taken the solid content of Car-Na-Var (which combines varnish gums and hard waxes) and emulsified it to use on rubber and composition floors. The result is "Rubber-Var."

Rubber-Var is waterproof and is applied with a mop, drying almost as fast as it is applied. It is then polished by buffing, responding to a very high polish. Rubber-Var forms a protective coating for rubber or soft composition floors, preserving them from their natural enemies—oils, air and the friction of traffic; also making the rubber or soft composition floor much easier to clean and keep clean, eliminating the need of frequent scrubbing. It also prevents colors from "running." Longer lasting than self-polishing waxes. Waterproof. *Meets U. S. Treasury specifications for "Undercoater B" and Item 8 of proposed Federal specifications.*

SILENT CHIEF ELECTRIC FLOOR MACHINE

Like driving a high-powered automobile, the "Silent Chief" actually runs itself . . . you merely hold lightly onto the handle to steer. Special geared-head motor gives maximum efficiency . . . yet hours of polishing, scrubbing, steel wooling, sanding or grinding will not tire the operator because its perfect balance calls for no physical effort. Can be easily converted into a rug-scrubbing machine. Made in 5 sizes.

CAR-NA-PAINT—Car-Na-Paint for floors is made by grinding color pigment into Car-Na-Seal, giving the same very durable, flexible finish as Car-Na-Seal. Because it is highly alkali and acid-resisting, Car-Na-Paint is especially adapted for concrete floors. Applied with paint brush. Coverage same as Car-Na-Seal. Supplied in following colors: Light Gray, Dark Battleship Gray, Maroon, Dark Brown, Battleship Brown, Tile Red and Green. *Meets Item 5, Type III of proposed Federal specifications.*

DE-TER-GO—De-Ter-Go is a white powder, manufactured by a special process resulting in a cleaning agent of most remarkable qualities; a cleaner so mild that it may be handled freely, may be used in the bath, and yet so powerful, when properly used, that it will remove paint and varnish. For cleaning oil-soaked floors it has no equal, removing the surface oil and restoring the former color of the floor without harming the floor. De-Ter-Go is also especially adapted for cleaning rubber floors. *Meets U. S. Treasury specifications for "Cleaner B," and Item 2 of proposed Federal specifications.*

CLEAN-O-SHINE—Clean-O-Shine is a cleaner of a creamy consistency and is free from alkali, acids or abrasives and therefore harmless to the finest finish; at the same time, it is a highly efficient cleaner. Being made of a high grade vegetable oil, it is, in fact, a "floor food" and if not rinsed after scrubbing, acts as a filler on porous surfaces, while on varnished or painted surfaces it renews the luster and forms a protective coating. It possesses a very pleasant, sanitary fragrance which has a decided deodorizing effect, eliminates the smell of wet wood, soapsuds, etc., as well as other disagreeable odors. If to be followed with Car-Na-Var, Car-Na-Lac, etc., floor should be rinsed free of Clean-O-Shine. *Meets U. S. Treasury Department specifications for "Cleaner A," and Item 1 of proposed Federal specifications.*

STERI-LAC — Floor Treatment

After months of experimenting, our research chemists have developed a new heavy duty floor finish that contains a powerful germicide. Independent tests prove that Steri-Lac will kill typhoid and other resistant disease causing germs within five minutes after application.

Steri-Lac is non-toxic and limited contact will not irritate the skin. It does not have an objectionable germicidal odor. In effect, Steri-Lac is a lacquer made of wax with germicide added in such a way as not to impair the appearance or durability of the treatment. Dries with a uniform, streakless, lacquer-like gloss. Double-duty Steri-Lac assures beauty and protection to floors plus protection from the spread of contagious disease.

CAR-NA-VAR PORTABLE VACUUM

For Wet and Dry Pick-up

Never before has a portable heavy duty vacuum machine offered such powerful cleaning action plus such quiet operation . . . quieter even than a small household machine. Designed for both "wet" and "dry" pick-up, the new silent Car-Na-Var is an ideal machine for the school, where quiet and cleanliness are of equal importance in the daily routine. The new compact design makes the Car-Na-Var easier to use, easier to keep clean. New sturdy construction means trouble-free operation . . . longer life.

Picks up 6 ft. "2 x 4"

THE FULLER BRUSH COMPANY

INDUSTRIAL DIVISION — DEPT. 60

Hartford, Connecticut

World's Largest Manufacturer of School Cleaning Equipment

Something to be proud of — American Schools

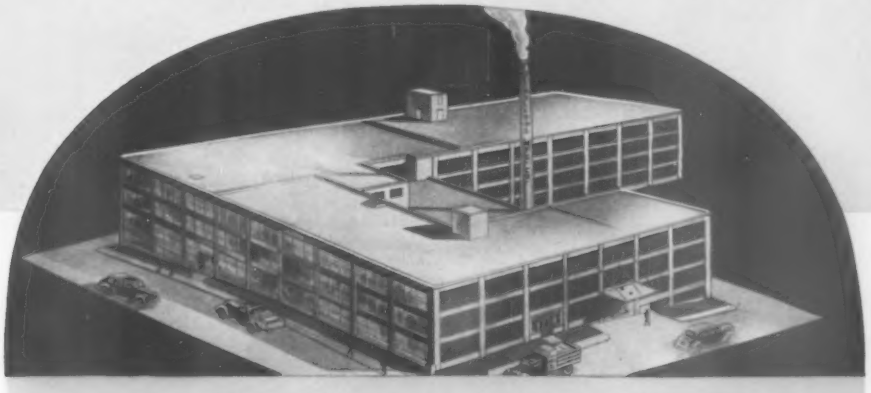
Thousands of them are kept clean and attractive with famous Fuller Brooms, Floor Brushes, Mops, Dusters, and other aids to school maintenance

Whether yours is a large metropolitan school or a single room in the country, the problem is the same. Fuller is prepared to furnish the equipment to protect the child's health by providing cleanliness. In such an atmosphere pupils do their best work.

Fuller Cleaning Tools are made by experts of the best available materials. Quality and value considered, these nationally used products are reasonably priced.

We welcome your inquiries and your annual supply bids. Send for our special School Cleaning Equipment Catalog

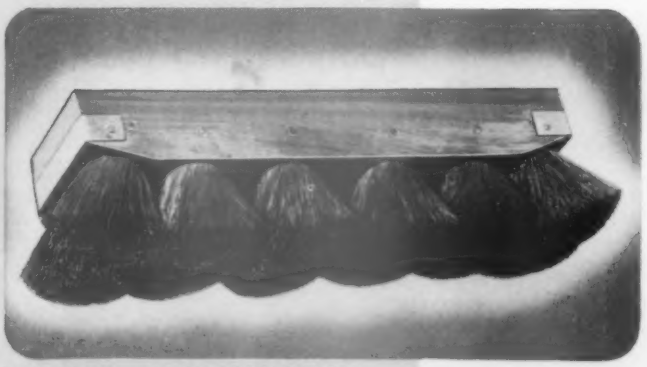
J. I. HOLCOMB MFG. COMPANY.



USE CLEANING TOOLS and CLEANING CHEMICALS BUILT TO WORK *TOGETHER!*

For nearly half a century we have studied cleaning tools and cleaning chemicals. You can learn much about them, and the problems they must solve, in that time. Special tools and chemicals built to do specific jobs—built to the specifications of the men who use them—built to work ***together*** . . . help solve your manpower problem by doing a ***good*** job FASTER. Invest in tools built to work together . . . you'll have a cleaner institution at a lower ***labor time*** cost.

1896 *Write for "Floor Maintenance Bulletins" (See Page 7)* 1945



VITALIZED CLEANING COMPOUND—*and*—THE No. 4066 SCRUBBER . . . . .

WATER PROOF WAX . . . . . —*and*— THE JUMBO DUSTLESS SWEEPER

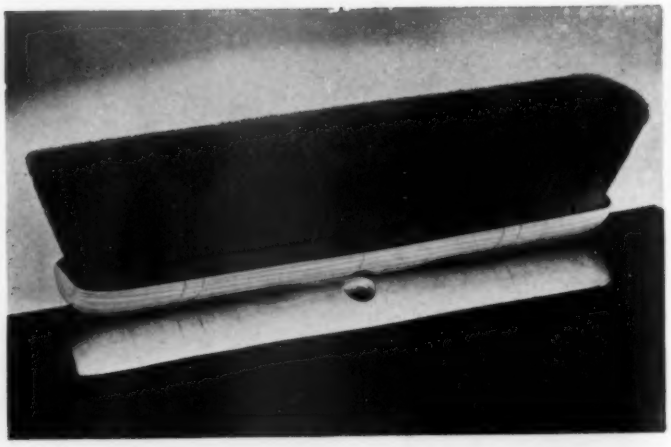
Holcomb tools work faster . . . clean more thoroughly the first time over . . . make money by cutting maintenance time. If your Holcomb tool saves only one hour of cleaning time each day, that is a new profit of $182.50 a year . . . on each man (at 50c an hour).

© 1945. J.I.H.Mfg.Co.

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

for Sweeping Smooth and Medium Floors
. . . The "BOMBER"

The scientifically mixed center stock of tested fiber and horsehair is a one-stroke dirt mover. Working together, this center stock kicks the dirt ahead and the outer casing of stiff grey horsehair keeps it and the fine dirt moving. Stock 3⅜" out of block. 12-14-16-18-24 inch blocks, handles included. ***Pitch Set.***



for Sweeping Smooth and Medium Floors
. . . The "RACER"

Stock center is hair and fiber—outer casing is all snappy, selected hair for keeping fine dirt ahead of the brush. Each hair **sweeps** because full stock keeps it working with the end only. Stock 3⅛" out of block. 14-16-18-24 inch blocks, handles included. ***Machine Set.***

Write Us for Prices on Bristle Floor Brushes

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

The *Holcomb*

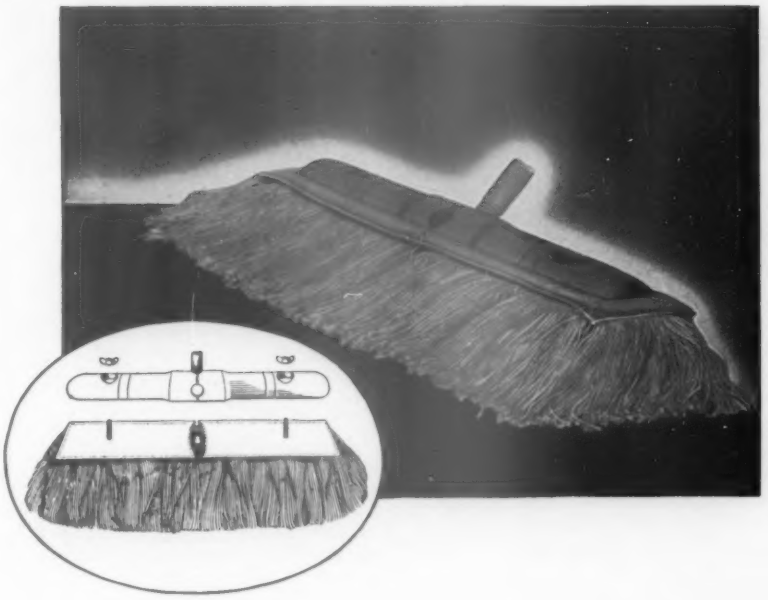
JUMBO DUSTLESS SWEEPER

SANITARY - QUIET - ECONOMICAL

SWEEPS, DUSTS, POLISHES

In one wide, fast stroke

Cleans, dusts, polishes—QUIETLY—and its chemically treated yarn *holds* the dust and dirt until shaken out. Heads of long, staple cotton sewn on heavy fabric are removable, interchangeable and easily laundered. Can be re-treated with Nu-Finish after washing. It SPEEDS cleaning!



Germ Free

Does Not Disturb Classes

A SPEEDY Worker

COMPLETE BLOCK AND HANDLE WITH HEADS

No. 412—12" block	No. 424—24" block
No. 414—14" block	No. 436—36" block
No. 418—18" block	No. 442—42" block

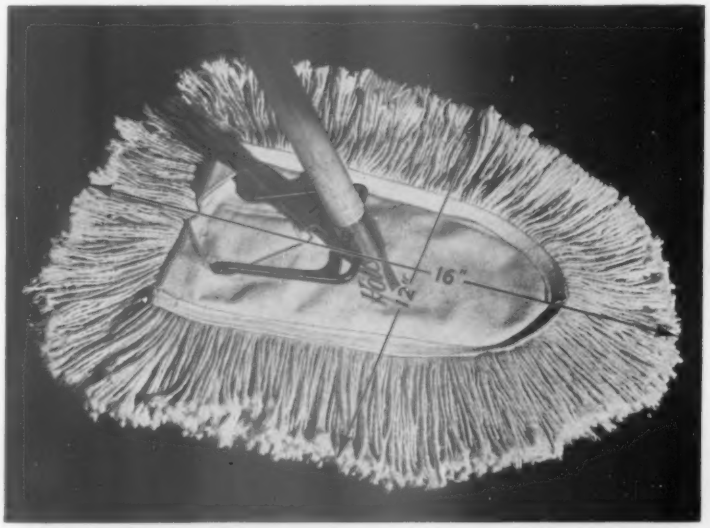
HEADS ONLY

No. 413—22" yarn spread	No. 425—34" yarn spread
No. 415—24" yarn spread	No. 437—46" yarn spread
No. 419—28" yarn spread	No. 443—52" yarn spread

for Dusting the Hard-to-get-at Places FAST...

The No. 340 DUSTER

At any angle you hold the Holcomb 340 for dusting woodwork, floors, door casings, walls or ceilings —the face is always *flat* on the surface. Covers and cleans *more* surface, *faster*. Chemically treated soft cotton strands sewn on heavy canvas—slips easily on sturdy frame. Easily laundered and re-treated with Nu-Finish.



No. 340—*Mop frame and head complete*

No. 341—*Mop head only*

No. 342—*Two 341 heads on double frame complete*

The No. 341 Used as a MITTEN DUSTER

. . . makes for fast, efficient dusting . . . the chemically treated yarn picks up and holds more dust. Canvas back protects hands. A "swipe" and it's dusted.

***Re-treat Yarn Dusters and Sweepers with Holcomb* NU-FINISH**

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Holcomb **LIQUID**

*"for more **BEAUTIFUL FLOORS**"*

WATER-PROOF WAX *IS* WATERPROOF!

Not Merely Water Resistant

Make This Water Test Yourself!

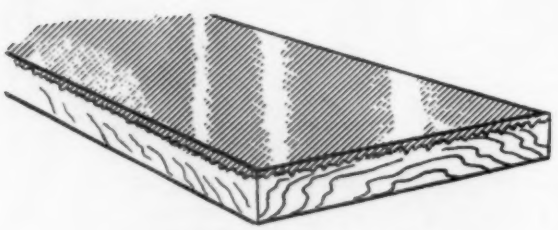
Holcomb Water-Proof Wax Lasts Longer, Patches Perfectly

Water was dropped on each of the six dry spots of wax on this test glass. ***No. 1 is Holcomb Water-Proof Wax.*** After standing for a few minutes, 5 of the wax spots had emulsified. When wiped off with one hard stroke (as shown by the streaks on the glass), wax came off 5 of the spots. The grey spot on Wax No. 1 (caused by the hardness of the water used) disappeared in about 10 minutes. Holcomb Wax can be ***wet mopped.*** It is clear, brilliant and protects your floors LONGER. It cuts down number of waxings in a year and, in addition, it ***patches perfectly in traffic lanes.*** It is TOUGH—ELASTIC and does NOT CHIP.

Use Holcomb WATER-PROOF WAX to coat your floor and keep it immaculate and glistening with the Holcomb JUMBO DUSTLESS floor sweeper which sweeps—dusts and polishes in a once-over stroke. Cut maintenance time in two with Water-Proof Wax and a JUMBO on the job.

In 55 - 30 - 15 - 5 gal. Drums

SEAL-COAT ...*The Perfect SEAL for Wood Floors*



IT PENETRATES!

You Must Wear Off the Wood to Wear Off the SEAL-COAT

Seal your wood floors, whether new or old, with Holcomb Seal Coat. It PENETRATES! It brings out the natural color and grain of the wood and protects the surface. Seal Coat, in penetrating, combines with the wood to form a new, protective ***tread.*** It is more easily swept because the grain of the wood is filled. That speeds the sweeping job. Your floor may be waxed also. Using Holcomb Water-Proof Wax on a sealed floor gives it greater beauty, makes it more durable and makes for less maintenance cost.

In 55 - 30 - 15 - 5 gal. Drums

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Holcomb PURITINE

The 3 INGREDIENT CLEANING COMPOUND

① **Dirt and Grease Solvent**
② **Free Rinsing Agent**
③ **Water Softener**

No matter where you clean with water—use PURITINE. It is universal in its uses—floors, walls, woodwork, painted or varnished surfaces, in the laundry, the kitchen. It will harm no surface . . . is free rinsing, leaves no soapy film and cleans FAST with little washing. It acts fast on the heaviest grease and dirt, costs only a penny a pail and goes 3 times as far as ordinary cleansing compounds.

PURITINE 100% ACTIVE 100% SOLUBLE

Makes YOU Money by Cleaning FASTER and EASIER and by Going 3 Times as Far as an Ordinary Cleaner

In 325 lb. Bbls., 150 lb. Half Bbls., 60 and 30 lb. Drums

THREE HOLCOMB LIQUID CLEANERS

VITA-PINE

***Ideal For Removing* RUBBER "BURNS"!**

Vita-Pine cleanses all floors, woodwork, painted walls, furniture or any washable surface SPEEDILY and leaves a refreshing pine odor. It takes only ONE-HALF pint to a bucket of water to do the normal job. As a neutral cleansing and deodorizing agent, it is tops.

V. C. C. (VITALIZED CLEANING COMPOUND)

for that TOUGH Floor or Wall Cleaning Job.

SOAP CLEANER . . . *a NEUTRAL Type Liquid Floor and Wall Cleaner.*

In 55 - 30 - 15 - 5 gal. Drums

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

A "one-armed" man, with Holcomb Window Cleaner, can clean a window as fast as a two-armed man with the ordinary window cleaners.

for Windows . . . Glass Cabinets, etc.

Holcomb

WINDOW CLEANER

SPRAY IT ON—WIPE IT OFF—and you have a sparkling, brilliant glass surface—no film and you've done the job in half the usual time. Here is a Holcomb product that is helping to relieve the manpower shortage in building maintenance everywhere.

1 gal. bottles and cartons of 4 1-gal. bottles

Holcomb WHITE STREAK *Quick-as-a-Flash!*

for BATHTUBS, URINALS, WASHBOWLS, SINKS, ETC. . . . of Porcelain, Tile, Enamel, or Granite . . . IT'S FAST

Another time and labor saving cleanser is "quick-as-a-flash" WHITE STREAK. One swipe and the dirt's off. Especially good for rest room fixtures and college and school utensils of enamel, granite, etc. White Streak cleans so thoroughly (on tile walls, for example) that things stay clean longer.

275 lb. Bbls., 80 lb. Kegs, 25 lb. Drums
(Cartons of 6 1-lb. Shaker Cans)

The No. 15 MOP

. . . IT HOLDS *MORE* WATER

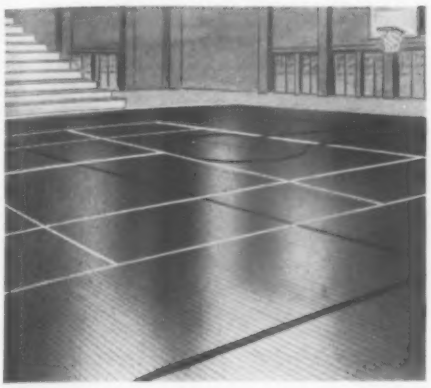
The Holcomb No. 15 Mop is the result of years of experience and experimentation. IT HOLDS MORE WATER! That means fewer trips to the mop bucket. It is a strong, most absorbent, "lintless" mop. The long, strong, absorbent strands have no linters to pull out. It mops more floor surface per trip to the bucket and—it picks up more water per trip from floor to bucket. This means ***faster*** mopping with less labor and that means lower mopping cost per classroom!

No. 15 MOP HEADS

16 oz. heads, 6½ x 17"
20 oz. heads, 6½ x 17"
24 oz. heads, 7 x 19"
32 oz. heads, 7 x 21"

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Holcomb GYM FINISH *IT'S MADE TO "TAKE" IT!*



One of the most ***enduring,*** mirror-like gym finishes. It takes untold abuse without injury to the appearance of your floor. It covers 600 to 800 sq. ft. per gallon . . . and gives you—

- ***a Natural Color Floor***
- ***a Mirror-like Finish***
- ***a Slip-preventive Surface***
- ***a Rubber Burn Resistant***
- ***a Floor Easily and Economically Maintained***

In 55, 30, 15, 5 Gallon Drums

VITA-PINE . . . *Ideal for Removing Composition Rubber "Burns"*

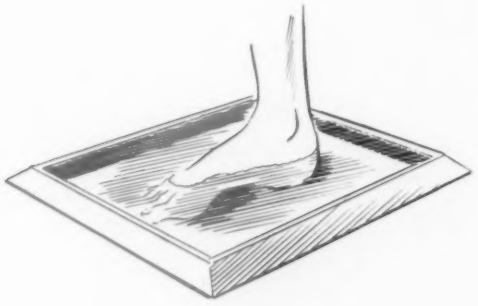
PINE-OLA Disinfectant *and* Deodorant

Why bother with two, three or four different solutions for disinfecting and deodorizing when all-purpose Pine-Ola will do the whole job? From rest room to garbage cans, it's ***the*** ALL purpose, money saving solution.

In 55, 30, 15, 5 Gallon Drums

Holcomb FOOT-BATH FUNGICIDE

...*A Preventive Against Spread of "Athletes Foot"*



"FUNGICIDE" is a liquid concentrate, the diluted solution of which ***KILLS*** the fungus causing "Athlete's Foot". It does not bleach, stain or irritate. Use it in foot baths in shower rooms, locker rooms, gymnasiums, swimming pool rooms. Can be sprayed or mopped for a disinfectant. Dilution: 1 part to 100 parts of water. ***Non-corrosive.***

In 55, 30, 15, 5 Gallon Drums

Write for any of these *Floor Maintenance* Service Bulletins . . .

Asphalt Tile	**Cement**	**Linoleum**	**Marble**	**Slate**	**Tile**
Composition	**Cork Tile**	**Magnesite**	**Rubber**	**Terrazzo**	**Wood**

The J. I. Holcomb Mfg. Co. maintains this Research Laboratory and its staff for the advancement of the science of cleaning and maintenance. The Bulletins above on correct, money-saving floor maintenance, are only one of the many services it renders you. If you have a cleaning problem—write the Holcomb Research Laboratory. They will help you solve it . . . satisfactorily.

—From Research Laboratory of the J. I. Holcomb Mfg. Co.
Cold Spring Road, Indianapolis 7, Indiana.

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Holcomb SPECIAL ITEMS

FLOOR TREAT

SPRAY IT ON— SWEEP IT OFF!

MAINTAINS WOOD FLOORS FOR *LESS!*

For treating unsealed wood floors and in maintaining varnished wood; Linoleum, Rubber, Composition, Tile, Terrazzo, etc., and waxed or unwaxed surfaces of wood or steel. Restores natural finish and builds up a glossy surface. Your floors sweep FASTER!

DISHWASHING COMPOUND

For ***machine*** dish washing ONLY! It's FAST . . . and free rinsing without leaving soapy film. No scale in machine. Economical, one-half oz. per gallon of water. Dishes and glassware remain free of deposits and water marks.

No. 16 BENCH DUSTER

5 *Dusters in* ONE! Saw yourself a "new" bench duster when the end bob wears down. The No. 16 cleans benches, chalk rails, desks or ANYTHING, ***FAST!*** "Bob" constructed for strength, each bob an individual unit, "flared" and full of snap.

METAL LUSTER . . . *Liquid Metal Polish*

Cleans and polishes ALL metal surfaces with little or no rubbing. Brass, Copper, Stainless Steel, Bronze, Nickel. Merely apply—wipe off with ***clean*** soft cloth. It's SPEEDY!

No. 6 TOILET BRUSH

This famous Holcomb tool has the stiff wings that get the scum under the rim. Straight handle for an all around the bowl stroke without changing grip. A clean bowl is odorless.

Use It with "BOWL CLEANER"

Regular use of Holcomb Bowl Cleaner keeps toilets free from discoloration, scum and lime. The No. 6 and Bowl Cleaner make a perfect Holcomb team.

STOP-GO . . . *Keeps the plumber out of your DRAINS!*

Stop-Go dissolves or loosens foreign matter which clogs drains, grease traps, toilets, wash stands, shower drains, etc. One can dissolved in 2 qts. of boiling water opens a stopped drain in 2 to 10 minutes.

FRESHETTES . . . *Rest Room Deodorant*

They are for ONE purpose only. Holcomb FRESHETTES ***replace*** objectionable odors in lavatories and urinals with a pleasant fragrance. Insoluble in water. 6 to a can. Cartons of 4 and 12 cans.

"INSEKIL" . . . for FLIES - BUGS - ROACHES

It's for Flies, Moths, Mosquitoes, Ants, Roaches, Bedbugs, Water Bugs, Spiders, Centipedes. Knocked down 100% of flies in 10 minutes (Peat-Grady Test).

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

HOLT MANUFACTURING CO.

Newark, New Jersey — Oakland, California

Address all inquiries to HOLT MFG. CO., Oakland, California

FLOOR MACHINERY MANUFACTURERS ASSN. FLOOR CARE PAYS MEMBER

Illustrated below is the new Holt Underslung, the quietest running, most reliable floor maintenance machine you can buy. Note long forward thrust of the brush, extremely low height. (4½-inch.) The Underslung gets under furniture, eliminates handwork, will clean, polish more floor at less cost. Nine Holt attachments available; made in seven models, four sizes

Looking for lower cost FLOOR MAINTENANCE?

With today's traffic in your building or school heavier than ever, are you satisfied with the floor maintenance service your present equipment is delivering? If not, then you should check Holt. Holt floor equipment is exclusively of pre-war quality and will service the average floor or floor covering in less time than most floor machines of equal size.

Holt equipment will do this year in and year out because each machine is *precision-built* and of one quality—TOPS. For years, all Holt research and engineering has been given to Holt floor maintenance equipment because Holt makes no other products. As a result, with a Holt you can expect years of dependable, uninterrupted service, with greater efficiency plus the lowest possible expense for upkeep.

Again, if you have floor maintenance problems—check Holt. This better equipment is now available on priority and we'll be happy to advise on the priorities available for your particular needs. Write today for full information. There is no obligation.

NEWARK, NEW JERSEY **HOLT MANUFACTURING CO.** OAKLAND, CALIFORNIA

Address all inquiries to HOLT MFG. CO., Oakland, California

HILD FLOOR MACHINE CO.

ESTABLISHED 1927

1313 W. Randolph St., Chicago 7, Ill.

Manufacturers of Floor Machines and Portable Vacuums . . . used for maintaining floors of all kinds and for many dust-control jobs

Plain-Handle Floor Machine

Used with easily interchangeable attachments to scrub, wax, polish, buff, sand, grind or steel-wool floors of all kinds . . . as pictured at bottom of this page.

HILD FLOOR MACHINES

Electrically Operated

The HILD Floor Machine is 100% efficient because the entire weight is on the brush. However, being self-propelling, this machine operates so easily that even a woman can run it for long periods without tiring. It operates continuously, in and out of corners, around columns, goes right up to the baseboard and under the edges of desks.

Only highest quality materials and workmanship are used in the manufacture of all HILD Machines. On Model "C" and "D" Machines, a 40-degree continuous duty Vertical Capacitor Gear Motor is employed. This motor has no brushes or commutator to wear out. The multiple transfer gears which transmit power from motor to bush divide the load, thereby reducing individual tooth stress, vibration, gear noise and power loss. These motors are completely mounted in rubber for silent, vibrationless "cushioned power." All models are equipped with rubber bumpers and the HILD Safety Switch which automatically shuts off power when operator's hands are removed from the handle.

Portable Tank Type Floor Machine

Used with the Hild Shower-feed refillable Brush, pictured below, to scrub floors or to shampoo rugs and carpets without removing them from the floor. Also waxes, polishes, buffs, sands, grinds and steel-wools floors.

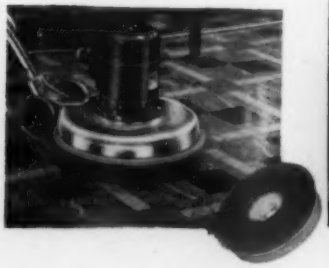
SPECIFICATIONS: ***Four Popular Single Brush Models***

Plain-handle Floor Machine		***Junior***	**Model "A"**	**Model "C"**	**Model "D"**
Motor:	(Continuous duty)				
	Manufacturer	G.E.	G.E.	G.E.	G.E.
	Horse Power	¼	1/3	½	¾
	Temperature Rise	40°	40°	40°	40°
	R.P.M.	1725	1725	1725	1725
Cable:	Length	40 ft.	40 ft.	40 ft.	50 ft.
	Gauge of wire	16	16	14	12
Brush:	Diameter of spread	11 in.	14 in.	16 in.	19 in.
	Diameter of Brush Block	9½ in.	12¼ in.	14 in.	17¼ in.
	Speed (R.P.M.)	180	180	172	172
Height:	Floor to top of motor	11½ in.	12 in.	14½ in.	15 in.
Weight:	Complete with brush and cable, aluminum base	55 lbs.	65 lbs.	100 lbs.	132 lbs.
	With cast iron base	62 lbs.	74 lbs.	118 lbs.	152 lbs.
Additional Specifications for "Shower-feed" Machines —					
Tank Capacity		3 gal.	3 gal.	3 gal.	3 gal.
Weight:	Complete with brush, tank and cable, aluminum base	71 lbs.	79 lbs.	110 lbs.	142 lbs.

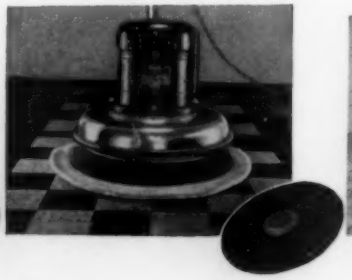
HILD Shower-feed Brush

This patented brush is used on the Hild Portable Tank Type Floor Machine to scrub floors (as pictured on the opposite page) and to shampoo rugs and carpets. The diagram shows how it works. Scrub-soap solution is fed from the storage tank to the back of the brush and is scientifically distributed to the channels running around the hub. In the bottoms of these channels are accurately spaced holes, penetrating the brush-back *between each row of bristles.* Soap solution passes through these holes and is evenly and economically distributed under the entire brush area. Brush is refillable.

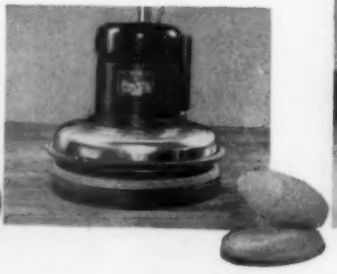
FLOORS OF ALL KINDS waxed · polished · buffed · ground · steel-wooled · sanded



WAXING AND POLISHING floors to a hard, lustrous finish with polishing brush on HILD Floor Machine.



BUFFING with lambs' wool or felt buffer on HILD Floor Machine. Removes streaks, goes under radiators, polishes waxed cove baseboards.



STEEL-WOOLING with pad and holder on HILD Floor Machine. Used for dry cleaning, polishing, scrubbing, wet buffing of penetrating seals, etc.

SANDING disc on HILD Floor Machine sands wood or cork tile. A 3-inch flat counter-sunk plate holds sandpaper firmly to rubber padded metal disc.

HILD "All-Purpose" Portable VACUUM MACHINE

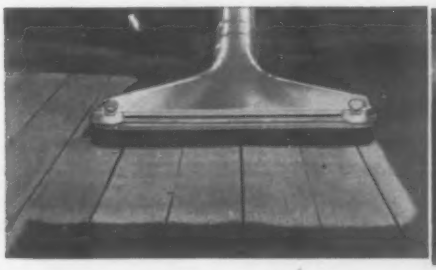
Here is a truly "all-purpose" vacuum . . . used without adjustment or change of parts to pick up either dry dust or liquid waste. With a series of easily interchangeable attachments, this machine can be used to simplify dozens of dust-control or dirt pick-up jobs, like those pictured on this page.

The machine rolls easily on four 3-inch casters. The dust arrestor tank is 22 inches high and 15 inches in diameter with ample capacity for recovered dirt. The machine is furnished with a ½ H.P. Black & Decker 8000 R.P.M. universal motor to operate on 115 volt D.C. or 25-30-50-60 cycle A.C. inclusive. Standard equipment includes the hose, handle and floor tool shown above and also a 5-inch utility tool.

Send today for

FREE BOOK

24 pages of data on floor maintenance and useful tips on dust control.



SWEEPING FLOORS

with brush attachment on HILD Vacuum. No cloud of dust, no sweeping compound needed. Removes dirt from cracks as well as from the surface.

CLEANING PIPES

with special attachment on extension handle of the HILD Vacuum. No ladders needed, no dust showered down onto floor below.

CLEANING SHELVES

with brush and utility tool on HILD Vacuum. Actually removes dust instead of pushing it from place to place or brushing it into the air.

CLEANING MOTORS

with blower attachment on HILD Vacuum. Machine can be used either as blower or vacuum to clean machinery, elevator shafts, air ducts, etc.

CLEANING WALLS

with brush and floor tools on HILD Vacuum. Used on walls of brick, concrete, etc., to prepare for painting . . . saves cost of washing.

DRYING FLOODED AREAS

with HILD Vacuum often prevents damage from heavy rains, a broken pipe, a clogged toilet, an over-flowing bath-tub, etc.

FLOORS . . . Shower-feed Scrubbed and Vacuum Dried

With HILD Equipment, floors of all kinds can be scrubbed cleaner, faster, more economically . . . and left dry and slip-safe. Applying the scrub-soap solution through the Shower-feed Brush on the HILD Floor Machine assures thorough scrubbing, saves waste, and prevents splashing walls or furniture. Vacuum-drying with a special squeegee attachment on the HILD Vacuum completely eliminates rinsing and mopping. Floors come up cleaner without streaks or squeegee marks. Since the floor is dried almost instantly, there is no danger of slipping due to wet floors.

THE HILLYARD COMPANY

BRANCHES IN PRINCIPAL CITIES — 370 Turk St. San Francisco 2, Calif. — St. Joseph 1, Missouri, U. S. A. — 1947 Broadway New York 23, N. Y. — DISTRIBUTORS FOR HILLYARD CHEMICAL CO.

A Floor Treatment, Maintenance and Sanitation Manufacturer with National Organization of Trained Engineers

Over Thirty-six Years Continuous Service

WOOD FLOORS

For Armories, Barracks, Recreation Centers, Class Rooms, Industrial, Commercial, Corridors, Dance Floors, etc.

Hillyard's Seals and Finishes are endorsed by the Maple Flooring Manufacturers' Association and by the National Oak Flooring Manufacturers' Association and have been specified by architects for years.

PENETRATING SEAL AND WAX

This treatment for sealing wood floors replaces natural rosins, fills voids and canals, feeds cells of wood, expanding and hardening the floor, giving a surface that can withstand severe abuse without showing traffic lanes or wear.

(1) First Coat—After final sanding the floor should be thoroughly swept. Then apply liberal amount of Penetrating Seal No. 21 with mop or applicator, applying the seal, first across the grain, then rub with the grain of the wood, allowing for as much penetration as possible. Allow to dry 12 to 24 hours according to drying conditions. Temperature of floor and room shall not be less than 70 degrees.

(2) Second Coat—Steel wool with No. 3 steel wool. For quickest and best results, use steel-wooling machine such as Hillyard's Steeltonian. Sweep floor thoroughly and apply second coat of Penetrating Seal No. 21, applying with grain, covering no more than 250 sq. ft. to the gallon. Allow 12 to 24 hours drying time, and then the floor should be steel-wooled to remove raised grain or nap. Temperature of floor and room shall not be less than 70 degrees at time of application.

(3) Wax Finish—All areas shall be swept free of dust and dirt, and two coats of Hil-Brite Self-Polishing Wax shall be applied according to directions.

(4) Reconditioning Sealed Floors—On floors that show traffic lanes, scrub the floor to remove all dressings, waxes, dirt, etc. Allow to dry, then apply Hillyard's Penetrating Seal No. 21 with sheepskin applicator, spreading with grain of the wood. Allow 12 to 24 hours drying time, according to drying conditions, then buff entire area with No. 3 steel wool, preferably with electrically driven steel-wooling equipment such as Hillyard's Steeltonian. Temperature of floor and room shall not be less than 70 degrees.

(5) Reconditioning Oiled Floors—Onto the oiled floor shall be spread a Shine-All solution consisting of 1 part of Shine-All to 7 parts water (use hot water). This solution shall be agitated for several minutes, preferably with electrically driven equipment such as Hillyard's Steeltonian or Hiltonian. The suspended oil and grime shall be removed from the floor with squeegee and pickup pan. Process shall be repeated, then the floor should be rinsed with clear water. Allow to dry thoroughly. Two coats of Penetrating Seal No. 21 shall then be applied in manner given in (1) and (2). Temperature of floor and room shall not be less than 70 degrees.

(6) Maintenance — Easy and economical — simply sweep with Hiltone treated cotton sweeping brush according to directions.

GYMNASIUM FLOORS—(Wood)

TREATMENT WITH SUPER GYM FINISH

Endorsed by Maple Flooring Manufacturers' Association and National Oak Flooring Manufacturers' Association and backed by more than one-third of a century of practical experience.

TREATMENT OF GYM FLOORS

This treatment produces a guaranteed non-skid finish that is long wearing and will add a non-glare lustre to the floor and will not turn dark or yellow with age.

(1) First Coat—Sanded or scrubbed floor should be first sealed with Hillyard's Wood Primer, applied liberally and spread evenly with lambswool applicator or brush. Allow 18 hours for thorough drying, then steel wool to remove raised grain or nap. Temperature of floor and room shall not be less than 70 degrees.

(2) All markings for athletic games shall be painted on top of the prime coat.

(3) Second and Third Coats—Apply two coats of Hillyard's Super Gym Finish according to directions, allowing 24 hours to elapse between coats. Steel-wool first coat of finish when dry, using No. 2 steel wool on electric steel-wooling machine, such as Hillyard's Steeltonian or Hiltonian Scrubbing Machine with steel wool pads. After thorough sweeping, final coat shall be applied evenly without laps. Temperature of the floor and room shall be not less than 70 degrees.

Note:—A diagram of official gymnasium markings will be furnished free on request.

CEMENT

Onex Seal immediately and effectively checks cement dusting. It seals the open pores of the cement and forms a smooth wearing resistant surface which is easy to clean and maintain. Onex Seal seals the cement against moisture, dirt and stains.

(1) Scrub cement with Shine-All according to directions. Rinse floor with clear water and allow to thoroughly dry. Apply first coat of Onex Seal in thin even coat, covering approximately 200 square feet at a time. Onex Seal shall be applied with sheepskin applicator. Rub Onex Seal into the floor, applying evenly. Proceed with other sections until entire surface has been covered. Apply second coat same manner as above, then buff with the polishing machine such as the Hiltonian Lowboy. Temperature of room shall be not under 70 degrees.

COMPOSITION FLOORS

Onex Seal will intensify the colors in magnesite and similar flooring, thoroughly sealing the installation, preventing penetration of moisture and disintegrating cleaning solutions, and provides smooth polished wax free surface.

(1) First Coat—After the area is thoroughly scrubbed with a neutral cleaning solution, such as Hillyard's Shine-All, apply a generous coat of Onex Seal, covering approximately a 200 sq. ft. area at a time.

(2) Second Coat—After first coat is thoroughly dry, apply second coat of Onex Seal same as in (1). After second coat has set, surface may be buffed to a deep mirrored polish. Temperature of room during application of Onex Seal shall not be less than 70 degrees.

ASPHALT TILE

(1) Immediately after Asphalt Tile floor has been laid, and prior to any traffic, all excess asphalt cement shall be removed and floor swept clean. A solution consisting of equal parts of warm water and Shine-All Neutral Cleaner shall then be spread on floor and allowed to dry.

(2) Just before occupancy of building, floor shall be scrubbed with a solution of 7 parts of warm water and 1 part Shine-All. Then rinse thoroughly with clear water.

(3) **Two Coats**—Hillyard's Hil-Brite Liquid Wax shall be applied according to directions as furnished by Hillyard's.

(4) If wax finish is not desired, apply evenly on clean, dry floor after operation (2), a solution of 40% Shine-All and 60% water, and allow to dry. Then buff with electric polishing machine.

RUBBER TILE

(1) Immediately after completion of floor, thoroughly clean with Shine-All Neutral Cleaner (1 part Shine-All to 7 parts warm water). Then rinse and allow to dry.

(2) **Two Coats**—Hillyard's Hil-Brite Liquid Wax shall be applied to clean, dry floor according to directions.

QUARRY TILE

PROTECTING AND SEALING

(1) Just before final inspection, Quarry Tile Floor shall be thoroughly cleaned with steel wool, using a solution consisting of 1 part Shine-All Neutral Chemical Cleaner to 7 parts of warm water.

Steeltonian
10 Inch—20 Inch

(2) After floor becomes thoroughly dry, a two-coat treatment of Hillyard's Onex Seal Finish shall be applied, strictly according to directions as furnished by the manufacturer, Hillyard's.

MODERN FLOOR MACHINES

STEELTONIAN is an economical machine to dry-clean wood floors, as it leaves a non-porous, non-slippery, easy to maintain, impervious to dirt surface. It is economical to operate, as rolled steel wool can be used on it.

HILTONIAN. The Hiltonian Combination Scrubbing, Polishing, Waxing machines. . . . Three models. . . . The sturdy 22" Master Lowboy. . . . The 19" all-purpose Lowboy. . . . The 16" handy Lowboy. . . . Coordinating speed, power and weight. . . . Two interlocking, interchangeable brushes, which eliminates streaking. . . . Timken bearings. . . . Underslung lines permit passing under desks. . . . Durable non-corrosive alloy construction. . . . Cuts time and labor in scrubbing, polishing and buffing.

22 Inch—19 Inch—16 Inch

NEW TERRAZZO TREATMENT

(1) **One Coat**—Within 48 hours after the Terrazzo has been "rough stoned," apply a liberal coating of Terrazzine according to directions furnished by the manufacturer, Hillyard Sales Company, St. Joseph, Mo.

This treatment shall be allowed to remain on the floor for at least 15 days and until other trades have completed their work. The surplus Terrazzine shall then be removed by "fine stoning" the floor until a smooth, finished surface is produced.

All grinding dust and dirt shall be removed by the contractor through washing with Shine-All.

Note:—In no case shall harsh abrasives or caustic soap powder be used in cleaning terrazzo.

OLD TERRAZZO

Onex Seal effectively seals Old Terrazzo against penetration of moisture, checks dusting, pitting and checking, and produces a lustrous, wear-resisting surface which is easy to maintain in an attractive condition. Onex Seal brightens and preserves the natural colors of Old Terrazzo.

SEALING OLD TERRAZZO

(1) Floors shall be thoroughly scrubbed with a neutral cleaner such as Hillyard's Shine-All, then rinsed.

(2) **First Coat**—After floor is thoroughly cleaned, and all spots and stains are removed, apply the first coat of Onex Seal, spreading it evenly with a Sheepskin Applicator, treating approximately a 200 square foot section at a time.

(3) **Second Coat**—When first coat of Onex Seal has been absorbed and the surface becomes dry, apply a second coat of Onex Seal, spreading it in a thin even coat, treating approximately a 200 sq. ft. section at a time. Temperature of the room shall not be under 70 degrees.

(4) That excess portion of Onex Seal which remains on the surface should be buffed to a deep mirrored sheen with an electrically driven polishing machine, such as Hillyard's Hiltonian Lowboy.

Tray
Foot Bath

HI-KO DISINFECTANT: A strong, clear, colorless, stabilized liquid germicide, fungicide and disinfectant. Splendid for combating Athlete's Foot and general use in the sanitation program.

FREE ON REQUEST ANY OF THESE SIX VALUABLE HELPS

HUNTINGTON LABORATORIES, INC.

DENVER — 45 University Ave., Huntington, Indiana — TORONTO

MANUFACTURERS OF SANITATION AND MAINTENANCE PRODUCTS FOR EVERY DEPARTMENT OF THE SCHOOL AND UNIVERSITY

● **FOR CLASSROOMS, CORRIDORS, AND OFFICES**

Floor Seals and Finishes, Floor Waxes, Scrub Compounds and cleansers for every type of flooring, Furniture and Desk Polishes, Blackboard Cleaners.

● **FOR WASHROOMS AND TOILETS**

Liquid Toilet Soaps, Porcelain Cleansers, Metal Polishes, Deodorant Blocs, Drain Openers, Toilet Bowl Cleansers, Deodorants and Disinfectants.

A COMPLETE CATALOGUE —YOURS FOR THE ASKING!

● **FOR GYMNASIUMS, POOLS, AND SHOWER ROOMS**

Seal-O-San, the Famous 100% Non-slippery Floor Seal and Finish, Odorless Derma-San, Liquid and Powder for Athlete's Foot Prevention, Tile and Marble Cleaners, Rubber Burn Mark Eradicator.

● **FOR LUNCHROOMS AND KITCHENS**

Huntington Laboratories manufacture a complete line of Dishwashing Crystals and Water Softeners, Insecticides, Metal and Porcelain Cleansers for use in lunchrooms and kitchens.

TWO FLOOR MAINTENANCE PRODUCTS DESIGNED TO SAVE TIME AND LABOR IN YOUR SCHOOL

FLOOR-SAN — LIQUID SCRUB COMPOUND

At last, floor cleaning has been reduced to its simplest terms —a single cleanser for every floor in your building! Away with special cleansers safe to use on only one type of floor! Away with janitors' wasted minutes and the complicated job of buying numerous cleaning products! Away with the fear of ruining fine flooring! When Floor-San takes over, floor cleaning problems vanish, for Floor-San promises thorough cleaning—with guaranteed safety—no matter where it is used!

Safe on All Types of Floors

You can use Floor-San with absolute safety on rubber tile, asphalt tile, linoleum, terrazzo, wood, or any other flooring. What's more you also get thorough cleansing, for Floor-San has powerful detergent properties which quickly rout dirt.

Floor-San a Time Saver

By using Floor-San for all floors, you save time for yourself and your janitor. You need buy only one product—Floor-San —and your buying job is done. The janitor saves time too because he can clean without the need for preparing special cleansers.

Flooring Manufacturers Approve It

Floor-San Scrub Compound has received the approval of the Rubber Flooring Manufacturers Association. It is also endorsed by asphalt tile manufacturers. Such approval means that Floor-San is mild . . . won't discolor . . . won't run colors.

Let Our Experts Help You

If you have a flooring problem that demands attention, write to Huntington Laboratories. Our trained flooring experts will promptly furnish you with practical information. If you desire, an experienced representative will call on you without any obligation on your part.

NEO-SHINE — CONCENTRATED SELF-SHINING WAX

Neo-Shine has a wax content 50% higher than the average self-shining wax. In addition, it is correctly made. That is why it is one of the most sought for waxes on the market today. One application alone lays a protective, thin wax film sufficient to withstand the hardest wear—a film soft enough to prevent powdering or marring, yet hard enough to give a smooth, dirt-repelling, water-resisting surface that will not track. Neo-Shine is properly balanced so that it can be readily removed from the floor when necessary. It will not build up—will not discolor the floor.

Withstands Rainy Day Traffic

Neo-Shine is not only wear-resisting—it is also extremely high in its water repellent action due to a new emulsifying agent. Unlike ordinary, quick-drying waxes, Neo-Shine shows no white spots from the dripping of water. Neither does it wash completely off the surface when it is mopped. For this reason, Neo-Shine is especially useful for treating the lower floors or entrances of buildings where water and snow are tracked in by pedestrians.

Guaranteed Safe on Rubber and Asphalt Tile

Because Neo-Shine contains no naphtha, turpentine or similar solvents, it may be used with complete safety on rubber tile and asphalt tile floors. It is approved and endorsed for use on all makes of asphalt tile flooring such as Tile-Tex, U. S. Rubber Asphalt Tile, Johns-Manville, Hanotile, Dura-Flex, and all makes of rubber flooring.

Neo-Shine is strictly a water emulsion wax. It dries quickly with a real sheen, without polishing. That saves labor. Just apply it with a clean lambs-wool mop and your floor looks like new.

SEAL-O-SAN

NON-SLIPPERY SEAL & FINISH FOR GYMNASIUMS

FOR AN EASILY APPLIED, ECONOMICALLY MAINTAINED, NON-SLIP GYMNASIUM FLOOR FINISH

● Gymnasium Seal-O-San—the Famous 100% Non-Slippery Floor Seal and Finish—is made expressly for gymnasium floors. This free flowing compound fills and hardens the wood fibres at the surface of the floor and thus prevents grease, dirt, or rubber burns from piercing the surface. It produces a beautiful, long-wearing playing surface, 100% non-slippery. It has no equal for withstanding the punishing action of basketball and other gymnasium activities.

Gymnasium Seal-O-San has been tried, tested and approved by more than 5500 schools—large and small—all over the nation. In Indiana—the home of basketball—more than 90% of all gymnasium floors are finished with non-skid Seal-O-San.

Mopped-on Finish Means Lower Cost

Slip-Proof Seal-O-San Prevents Accidents and Infections

Skids and falls rarely happen on a Seal-O-San finished floor because the 100% non-slippery surface permits quick starts and sudden stops without undue strain on leg muscles. Thus, many accidents which occur on slippery gym floors are eliminated.

Also, by sealing the floor, Seal-O-San fills any cracks and crevices and provides a smooth surface with no hiding places for "athlete's foot" spores or other disease germs.

The Seal-O-San Finished Floor Simplifies Maintenance

Seal-O-San cuts maintenance costs as much as 50%. For Seal-O-San is more than a surface finish. As the liquid penetrates deep, it fills the wood cells, hardens and seals the surface with a protective armor. Nothing can penetrate this finish. Thus, dirt, moisture and rubber burns remain on the surface of the floor—easily removed with a dustless mop. Costly scrubbing is seldom needed.

Non-Slippery Seal-O-San Gives the Floor a Beautiful Finish

Free-flowing, Seal-O-San leaves a natural, soft-lustre finish—as smooth and polished as the finest desk. And in spite of its deep penetration, Seal-O-San will not darken the floor.

Since Seal-O-San prevents dirt from getting into the wood, cleaning the floor becomes a simple matter. All that is needed to keep the beautiful finish lustrous and attractive is an occasional cleaning with a heavy dustless mop.

PENETRATING SEAL-O-SAN

PERFECT SEAL AND FINISH FOR WOOD FLOORS

FOR CLASSROOM FLOORS, CORRIDORS, AUDITORIUMS AND AREAS SUBJECT TO HEAVY TRAFFIC

● Penetrating Seal-O-San, like Gymnasium Seal-O-San, is a specially prepared floor finish that is quickly and easily applied with a mop. It contains hard drying oils and waterproof resins which penetrate deep into the wood and reinforce surface fibres. Thus, a Seal-O-San finish actually becomes a part of the wood. That is why a Penetrating Seal-O-San finish lasts for years. Since it leaves no surface finish to chip, crack, or peel, Penetrating Seal-O-San is ideal for use on floors subject to extremely heavy traffic.

Ordinarily, two coats of Penetrating Seal-O-San will seal the floor and give it an attractive dull sheen resembling hand buffed furniture.

How Penetrating Seal-O-San Prevents Traffic Lanes

Ordinary floor finish rests on the surface and as the brittle finish wears away, traffic lanes result.

A Penetrating Seal-O-San finish becomes an integral part of the floor. As the liquid penetrates it fills empty wood cells, then hardens to form a protective seal against dirt, moisture or wear. Because this seal extends below the surface of a Seal-O-San floor, you never see traffic lanes.

Method of Application Assures Low Cost

Superintendents will assure themselves of lower refinishing costs by demanding Penetrating Seal-O-San. For Penetrating Seal-O-San is applied by mop or wide brush without the use of highly skilled labor. Thus, it offers tremendous savings in labor over costly hand brushed finishes.

Coverage is generous, approximately 250 sq. ft. to the gallon for a two-coat application.

Advantages Over the Ordinary Type of Surface Treatment

Penetrating Seal-O-San provides a rugged, durable finish that stands up under severest punishment. It provides the fastest and most economical method of treating wood floors. Unlike surface finishes, Penetrating Seal-O-San will not crack, chip, or peel. It preserves and enhances the natural beauty of the wood and cuts maintenance costs to a minimum.

THESE SCHOOLS AND 5500 MORE USE AND APPROVE GYMNASIUM SEAL-O-SAN

Seal-O-San finished floors can be inspected and tested in every state of the Union. If these schools are "out-of-bounds" write us and we will gladly give you a list of Seal-O-San finished floors in your own vicinity.

Yale University
University of Arizona
Mesa College
University of Montana
University of Mississippi
Louisiana State University
University of Chicago
Ball State Teachers College
Notre Dame University
Purdue University
Indiana State Teachers College
Colgate University
Ohio State University
Otterbein College
Rutgers University
Oberlin College
University of Minnesota
Goodyear Tire & Rubber Co.
Stephens College
Missouri Southeast Teachers College
University of Tennessee
University of West Virginia
North Carolina State College
Annapolis Naval Academy
Virginia Polytechnic Institute
New York University
Baylor University
University of Kentucky
Center College
Bates College
North Texas State College
Iowa State University
College of the Pacific
University of Michigan
State Teachers College, E. Stroudsburg, Pa.
Swarthmore College
Tufts College
Rhode Island College
Deerfield Academy
Williams College

THE KENT COMPANY, INC.

174 Canal Street, Rome, N. Y.

FACTORY REPRESENTATIVES IN

NEW YORK · PHILADELPHIA · WASHINGTON, D. C. · HARTFORD, CONN. · LOS ANGELES, CALIF.

AND MANY OTHER PRINCIPAL CITIES

KENT

FLOOR MACHINES
VACUUM CLEANERS
ELECTRIC MOPPERS

This is the* QUIET KENT Model C15 ELECTRIC FLOOR MACHINE—*for scrubbing

It also performs with ease, speed and efficiency the tasks of polishing, buffing, sanding and steel-wooling.

This is a* KENT ELECTRIC DRY SUCTION—*for vacuum-cleaning

Powerful Suction, easily portable, plus a great variety of uses are noteworthy advantages of this KENT machine.

This is a KENT ELECTRIC MOPPER—*for water pick-up*

It dries floors quicker, cleaner, and sucks water up out of the cracks. Hand labor and old-fashioned methods cannot compare with the speed, efficiency and economy of this modern electrical tool.

★ ★

MODERN FLOOR CARE IN SCHOOLS REQUIRES MECHANICAL EQUIPMENT

★ ★

KENT SUCTION VACUUM CLEANER — *assures dustless cleaning of classrooms*

★ ★

A HIGH STANDARD OF SANITATION CAN BE MAINTAINED BY USING KENT EQUIPMENT

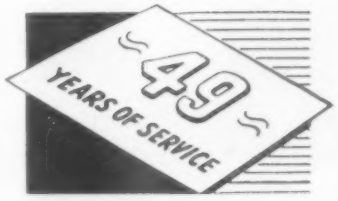
★ ★

LINCOLN-SCHLUETER FLOOR-MACHINERY COMPANY, INC.

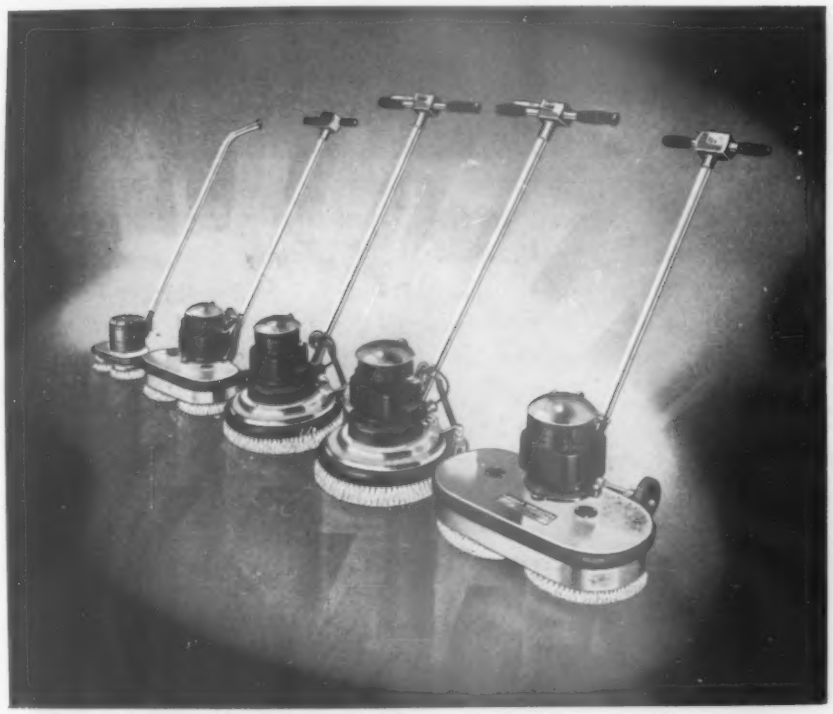
Manufacturers

540 S. Peoria Street, Chicago 7, Ill.

Phone: MONroe 5732



Floor maintenance equipment shown on this page represents but a few of the models which have made Lincoln products so favorably known to school and university managers for nearly half a century. We are again permitted to manufacture floor machines, but their sale must be authorized by the War Production Board on form WPB 1319. There is no restriction whatsoever on repairs, replacement parts, supplies, sandpaper, etc. Your needs along this line will receive prompt attention. New streamlined Lincoln models that defy comparison will be yours, postwar.



No. 11 No. 16 No. 15 No. 18 No. 20

The Lincoln Line of FLOOR SCRUBBING and POLISHING Equipment

No. 11. Small office or school model, with two brushes covering a floor span of 11 inches. Like all Lincoln models pictured above, you can use it for scrubbing, waxing and polishing floors of wood, linoleum, tile, concrete, etc. Even a child can operate it.

No. 16. Especially designed for efficient, fast and economical scrubbing and polishing in medium-size schools and institutions. All Lincoln polishing machines come fully equipped with interchangeable scrubbing and polishing brushes. The floor span of this machine is 16 inches.

No. 15. The Lincoln Single Disc "Sphinx" Silent Polisher and Scrubber. Full weight of the motor directly over brush. Perfectly balanced for easy operation. Equipped with safety switch. Brush covers in excess of 15" floor span and works right up to baseboard.

No. 18. This heavy duty single disc "Sphinx" Silent Polisher and Scrubber has a floor span of 18" and is ideal for large areas. Has an automatic safety switch, extra length guide handle and life time lubrication. May be equipped with tank and automatic water feed if desired.

Heavy Duty Twin Disc model . . . the world's fastest and most efficient polishing and scrubbing machine. Has 21" brush span. The twin brushes revolve in opposite directions eliminating all side pull or whip—thus even with its size this machine is guided without effort.

3 MACHINES FOR PRICE OF ONE!

LINCOLN-SCHLUETER MULTI-PURPOSE

Sands — Steel-Wools — Waxes and Polishes

Especially valuable for a variety of floors of different materials and of different age and condition. Sands old, warped, worn wood floors to reveal the hidden surface of smooth new wood. STEEL-WOOLS to remove accumulated oil, seal and grime, and to aid distribution and penetration when new seal is applied. WAXES and POLISHES wood, linoleum, tile, composition, concrete and terrazzo floors in your halls, classrooms, gym, auditorium and laboratories. Takes but a few minutes' time to change drums.

Weighs but 16⅔ Lbs.

For Table and Desk Tops—Stairs—Trim —Sills—Panels—Manual Training

NEW PORTABLE DUSTLESS DISC SANDER

Desk and blackboard sanding or refinishing is easy for your janitor or handy man with this streamlined portable sander. Doubles as manual arts shop equipment, sands furniture, millwork, desk and table tops, trim, stair treads, panels, etc. LEAVES NO DUST. Powerful suction captures all sand, grit and wood particles and "bags" them for disposal. Equipped with headlight for work in dark corners. Flexible 7" sanding disc conforms readily to uneven surfaces.

Guaranteed for 1 YEAR INCLUDING MOTOR

SERVICE—Repairs and replacement parts available now. New streamlined models, better than ever, will be available postwar. Representatives in all principal cities. Write!

THE SELIG COMPANY, INC.

DALLAS ATLANTA NEW ORLEANS

Manufacturing Chemists

Floor Finishes — Polishes — Disinfectants — Insecticides — Sanitary Products

ESTABLISHED 1896

SCRUBZOL

A Neutral Liquid Cleanser for All Types of Floors, Approved by Leading Flooring Manufacturers

Scrubzol is the choice of many architects and building managers because it cleans, brightens and protects the floors, impressively revealing the original colors. These results are brought about because Scrubzol softens the dirt and loosens the grease and grime without hard scrubbing, and since all floors are more or less porous, Scrubzol penetrates the pores of the floor causing the impregnated dirt and grime to become dissolved, forcing it to the surface where it is easily rinsed away.

Scrubzol should be used for all types of floors. It cleans, brightens and preserves linoleum, linotile, cork, rubber, asphalt, terrazzo, marble, magnesite, masonite, quarry tile, wood and concrete floors.

Scrubzol is a harmless chemical cleanser that is neutral, contains no acid, grit or free alkali yet is fast in its cleaning action and is completely soluble in hot or cold water. Scrubzol liquefies dirt, grease and grime, is a free rinse economical cleanser, and should be diluted two ounces to the gallon of water.

★ ★ ★

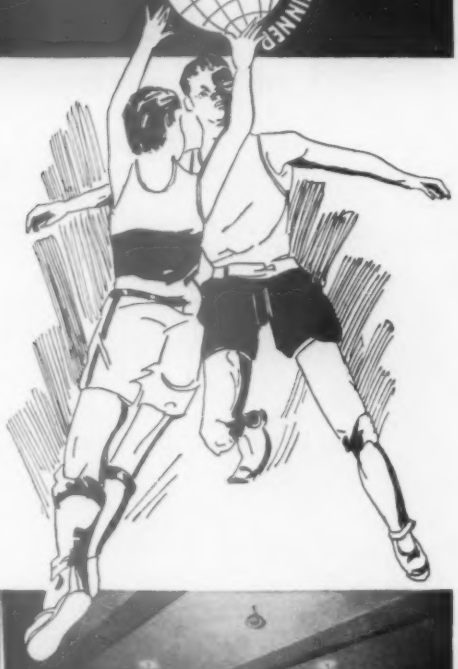
MAINTAIN HEALTH AND SANITATION WITH OTHER QUALITY PRODUCTS BY SELIG

Pine Disinfectant — Chlorine Disinfectant — Coal Tar Disinfectants — Pine Oil Spray — Deodorant Blocks — Insect Sprays — Floor Waxes — Furniture Polishes — Sanitary Supplies — Janitor Supplies.

Write for Our New General Catalogue and Floor Manual. YOURS FOR THE ASKING

JIM-KOTE

ALL THE WORLD LOVES A WINNER



SUPER GYM SEAL AND FINISH

Help your team to be a champion. School executives and coaches recommend Jim-Kote to provide a gym floor that will keep your team in the championship class.

Jim-Kote gives you a smooth resilient playing floor surface that is tough, durable, splinter free and fast, yet free from the usual slip hazards found in so many gymnasiums that slow down play and ofttimes cause injuries.

Your gymnasium floor correctly surfaced and properly maintained is a thing of beauty. Jim-Kote beautifies and protects the floor so that it may be a center of campus activities and in addition to athletic events can safely be used for entertainments, banquets, dances, oratorical contests and other gatherings without damage or injury to the floors.

Jim-Kote dries hard, thus seals the pores of the wood preventing the penetration of foreign matter so that surface dirt is easily removed. Jim-Kote is easily applied and may be used on any gymnasium floor . . . new or old . . . quickly putting it in excellent playing condition. Jim-Kote is a transparent durable bakelite seal and finish that will not chip, crack, peel or blister. Average of three coats is about 650 square feet per gallon.

SELIG'S GYM CLEANER

Synthetic and reclaimed rubber soles and heels play havoc with nicely finished gym floors.

Such scuff marks and rubber burns can be easily cleaned off with Selig's Gym Cleaner. Proper daily maintenance of your gym floor will increase its life of service and provide a good playing surface. Use Selig's Gym Cleaner and keep your gym floor in a good clean condition.

QUALITY TRADE HYGIENIC SELIG SANITARY MARK PERFECTION

G. H. TENNANT COMPANY

Established 1870

General Offices and Factory: Minneapolis 11, Minn.

Over 100,000,000 Square Feet of Floors Look Better and Last Longer because they are TENNANT MAINTAINED!

That's why Schools and Colleges Specify the Tennant System for Easy, Low-Cost Floor Maintenance

OVER A HUNDRED MILLION square feet of floors, including those in countless schools and colleges, today are kept clean, bright and wear-resistant with the economical, scientific Tennant System of floor maintenance.

An important reason for this popularity is the ease and speed with which school floors can be thoroughly "dry cleaned" and sealed by a simple operation using the Tennant floor machine. This process effectively hardens wood fibers and makes floors resistant to dirt penetration and scuffing.

In this manner floor surfaces throughout the school, in classrooms, in hallways, in gymnasiums and laboratories, may be kept smooth, bright and hard. Even the darkest of floors, frayed and softened from scrubbing, may easily be restored to their original durable, attractive brilliance. **How is the Tennant Machine used?** This machine is ideal for ALL school floor maintenance, including the reconditioning of old floors and the fast, systematic finishing of new floors.

Typical applications: "dry cleaning," applying floor seal, steel wool burnishing, dustless sanding, floor waxing, and floor polishing. Attachments for all operations may be quickly changed without use of tools.

"Dry cleaning," for example, is done by a fast-revolving drum-mounted steel wool roll. It thoroughly cleans the dirtiest floors in one rapid operation, removing soilage (which is vacuum-drawn into bag or built-in hopper).

The machine can operate flush with walls, is self-propelling and easy to use, and may be used for the maintenance of asphalt tile, linoleum and cork floors as well as wood floors. Partial refinishing in traffic areas may be done without showing lap marks.

CALL FOR A TENNANT REPRESENTATIVE. He will gladly explain the money-saving advantages of the nationally popular Tennant System, without obligation. He will also instruct your operator in the correct use of Tennant equipment.

The way to finer floors **TENNANT** *Floor Maintenance System*

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AND PRINCIPAL CITIES IN CANADA

WESTONE REMARKABLE NEW LABOR SAVING PRODUCT THAT SIMPLIFIES FLOOR MAINTENANCE

WESTONE IS . . .

a chemical floor treatment in liquid form which penetrates and blends with the floor material to form a hard-wearing, waterproof surface which helps to prevent grit, sand or dirt from being ground into the floor by foot traffic. Westone is not a floor oil and will not become gummy or sticky. It penetrates rapidly and evenly and unlike many other floor treatments, actually becomes a part of the floor material itself.

WESTONE PREVENTS FLOOR WEAR

because it brings a hard finish to a sealed wood floor which makes the seal permanent. It gives a tough protecting film to wood floors which makes the floor last much longer. To highly porous terrazzo, tile, composition and marble floors, Westone brings a positive binding action which helps prevent disintegration, erosion and decay.

HOW WESTONE CONTROLS DUST

The presence of dust in room atmosphere is due not so much to open windows as it is to floor traffic. When traffic is continuous dust never settles on the floor so the problem is to keep the dust from rising. Westone has, in addition to its other properties, a peculiar affinity for dust and where it is properly used to maintain a floor, the atmosphere will be comparatively free from it because foot traffic will not cause the dust to rise.

IMPROVES APPEARANCE

Different than most floor treatments which are put on a floor and then not applied again until their protective action has been outworn, Westone, if used as directed, will continuously improve the appearance upon each regular application.

THE LOW COST

Two factors make Westone economical to use. Ease of application enables one person to do the work of three in maintaining floors and, because Westone is highly diffusive, a small amount gives enormous coverage. On a sealed floor, one gallon covers 4,000 square feet when first applied. These two factors actually make the cost of maintaining floors with Westone less than with the old soap and water method.

NEW USE FOR WESTONE! CLEANS BLACKBOARDS

Wipe blackboard with cloth dampened with Westone. Wipe off excess with a clean dry cloth. Allow blackboard 12 hours to dry. Results will be amazing

WESTONE CAN BE USED ON CONCRETE OR ANY TYPE WOOD FLOOR

Other West Products Designed To Reduce Maintenance Costs

- Liquid Soap and Dispensing Systems
- Disinfectants and Deodorants
- Insecticides and Raticides
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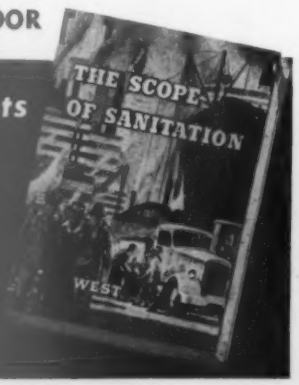
- Kotex Vending Machines
- Cleansers
- Floor Finishes



FREE Copy of this catalogue on request.

WEST DISINFECTING Company

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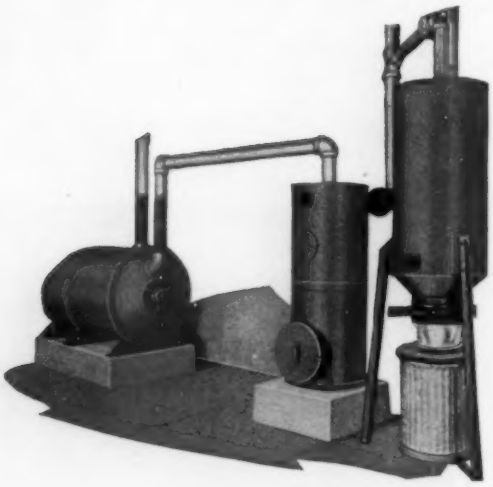
THE SPENCER TURBINE COMPANY

Hartford 6, Connecticut



THE SPENCER CENTRAL VACUUM CLEANING SYSTEM

The Spencer Central Vacuum Cleaning System has met with the approval of architects and engineers everywhere, and has been installed in more than 10,000 buildings, including more than 1500 school buildings.

Spencer Central Vacuum Cleaning is a permanently installed system for the speedy and complete removal of dirt and dust from all kinds of floors, walls, ceilings, furniture and other building equipment. It consists of five essential parts, each carefully selected to meet the special requirements for each individual building:

1. A vacuum producer, located in the basement. 2. Inlet valves, conveniently located on all floors and piped to vacuum producer. 3. Specially designed, entirely enclosed, and easily cleaned separator. 4. Light weight, flexible hose. 5. Special vacuum tools for each operation.

Advantages—In exhaustive tests in leading schools, the powerful vacuum, scientifically applied with correct tools, has demonstrated its ability to remove more of the dirt in less time than other methods.

Because the equipment is simple in design, requiring little attention and because these systems are built to provide satisfactory service over long terms of years, both the operating and amortization costs are extremely low.

One janitor can clean twelve average sized class rooms in two hours with a 3 HP Spencer System. The Spencer elbow joint makes cleaning around furniture easy.

For Cleaning Erasers and Chalk Trays—Spencer Vacuum Cleaning, instead of scattering the great bulk of the chalk dust on the floor, provides a method of cleaning erasers and chalk trays that is rapid, sanitary, easy and thorough. The janitor has only to attach a special tool and move it across the surface of eraser or chalk tray.

Swimming Pool Cleaning Equipment—By means of special cleaning tools usually employed in connection with the pump on the filtering system, it is possible to remove accumulated sediment from swimming pools without the waste of water involved in draining the pool. Bulletin on request.

In Boiler Rooms—Spencer Vacuum keeps boilers working at top efficiency by cleaning soot out of boiler tubes, in this way often saving the cost of the entire installation within a few years. Spencer Vacuum also keeps boiler room floors clean, and easily removes soot and dust from overhead pipes.

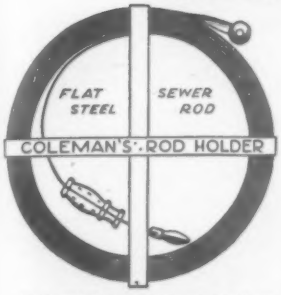
SPENCER PORTABLE VACUUM CLEANERS

The Spencer ⅓ HP Portable Vacuum Cleaner weighs only 34 pounds. The Spencer ¾ HP unit shown below weighs 150 pounds. Both are built on the same principles of design as the larger Spencer units, and use the same vacuum tools. Easy to clean, easy to use, and built for long life service.

ALLAN J. COLEMAN

120 W. Illinois St., Chicago, Ill.

COLEMAN'S SEWER and DRAIN CLEANING TOOLS



FLAT STEEL SEWER RODS

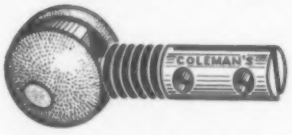
And Tools for Opening All Stoppages

All Rods are made of a special prepared Oil Tempered Spring Steel Wire and are fully equipped with Spear Point, Handle and Roller Ball.

FLEXIBLE COIL WIRE SEWER AND PIPE AUGERS

Made of the best Oil Tempered Spring Steel and are flexible, enabling them to turn bends and go through traps. Furnished with corkscrew and handle complete.

FLEXIBLE REVOLVING SOLID ROLLER BALL HEAD FOR SEWER RODS

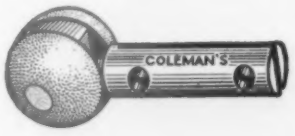


Equipped with 6 inch Flexible Spring Attachment which enables Rod to be rolled around any bend.

GIANT REVOLVING SEWER CLEANING SPEAR POINTS AND ROOT CUTTERS FOR SEWER RODS

Points revolve by pushing in and out of pipe. Will drill a hole through most any stoppage.

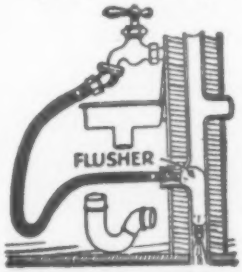
REVOLVING SOLID ROLLER BALL HEAD FOR SEWER RODS



This Ball Head is furnished with a solid shank to bolt onto Rods.

HYDRAULIC FLUSHER

(Water Pressure)



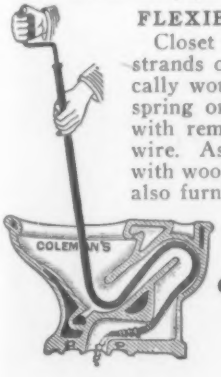
This **Hydraulic Flusher** is made of several plies of water-tight heavy rubberized fabric, which assures a strong, durable and flexible connection that is easy to insert into traps, vents, curved sewer drains or pipes.

HEADQUARTERS for all kinds of Flexible Sewer and Pipe Augers—Flat Steel Sewer Rods — Flexible Closet Cleaners—Wood Conduit and Sewer Rods—Basin Dips—Brass Suction and Force Pump—Suction and Force Cups —Hydraulic Flushers — Gauge Glass Cutters—Strap Wrenches—All articles can be purchased through your local Supply Jobber

LEAD JOINT RUNNERS

Our **Lead Joint Runners** are made to handle various sizes of asbestos rope which is furnished with clamp. Clamp is wrought steel formed with pouring funnel enabling hot lead to flow quickly to joint without waste.

FLEXIBLE CLOSET CLEANER



Closet Cleaners are made of 21 strands of high grade wire scientifically wound to form a solid flexible spring or shaft 3/8" O.D. Equipped with removable corkscrew and cone wire. Assembled with polished tube with wood grip handle. Other grades also furnished.

CAN ALSO FURNISH CABLES FOR SEWER MACHINE

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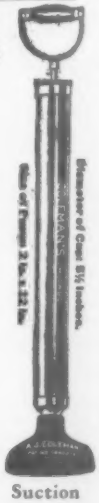
GAUGE GLASS CUTTER

Cadmium plated overall . . . with wood finished handle. Sizes made to cut from 8" to 30" lengths, inclusive.



Suction Pump

SUCTION PUMP

Has suction of 50 lbs. and a force of 100 lbs. or more. Equipped with large reversible red rubber cup, with cast brass screw connections.

FORCE CUP

Made of special grade large 5½" Red Gum cup. Corrugations on bottom give perfect seal.

Force Cup

"GUARD HEALTH" By Using COLEMAN'S Tools to Keep Sewer Drains Running Freely and Have Sanitary Buildings

J. A. SEXAUER MANUFACTURING CO., INC.

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SPECIALISTS IN PLUMBING AND HEATING MAINTENANCE MATERIALS FOR 24 YEARS

Today—leading maintenance engineers everywhere have standardized on 'SEXAUER' patented Precision Tools and Triple-Wear Replacement Parts—as advertised in THE SATURDAY EVENING POST

LEAKY FAUCETS WASTE PRECIOUS FUEL AND WATER . . . . One 1/32" leak in a hot water faucet wastes 76,000 gallons yearly, worth $10.13 at $1 per M cubic feet and costing from $27 to $50 for the fuel to heat it. Multiplied by many faulty fixtures and connections, this loss soon reaches staggering proportions.

Stop this waste the 'SEXAUER' way.

'SEXAUER' METHODS STOP LEAKS that soon ruin costly fixtures. This patented Precision Tool re-forms rough, raised, washer-chewing faucet and valve seats *better than new* to a smooth, round, corrosion-resisting surface, first step in a repair technique now popular with maintenance men everywhere.

"EASY-TITE" 300° F. FAUCET CUSHIONS, natural follow-up to the seat reforming operation, outlast ordinary washers 6-to-1. Built of a resilient synthetic that withstands extreme high temperatures—and fabric-reinforced like a tire—"Easy-Tites" resist absorption, won't split or mush out of shape. Other 'Sexauer' packings complete restoration of fixtures to long and useful service.

"MULE-KICK" CLEANERS—favorites for 24 years—cost less because they go farther. Safe to use—no fumes—no odors.

"Mule-Kick" Waste Pipe Cleaner prevents clogs, keeps drains free-flowing, sanitary.

"Mule-Kick" Closet Bowl Cleaner purges, deodorizes, restores glisten without rubbing or scrubbing.

"Mule-Kick" Creme Porcelain Polish wipes away stains, makes sinks, refrigerators, tile, metal, woodwork gleam like new. All three "Mule-Kick" products have full pre-war strength.

OVER 2,000 'SEXAUER' TRIPLE-WEAR REPLACEMENT PARTS and patented Precision Tools are geared to the need for lasting repairs and long-run maintenance economies. They're listed and illustrated in the big, new, 96-page 'Sexauer' catalog. Your FREE copy is waiting.

A NEARBY 'SEXAUER' TECHNICIAN *will gladly consult with you on plumbing-heating upkeep problems. He'll survey your installation, if you wish, reveal the latest repair methods, suggest economical, balanced stocks, whatever the age or style of your fixtures. You'll find it worth while to get his time and money-saving suggestions. No obligation. A postcard will bring him—and your free "Sexauer" catalog—promptly. Write today: J. A. Sexauer Mfg. Co., Inc., Dept. S, 2503-5 Third Ave., New York 51, N. Y.*

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LAWN QUIZ

Interesting — Informative

Hundreds of questions about Lawns. How to make them. How to renovate them. How to feed, mow and care for them generally. The many uses to which you can put your Lawn.

Answers are by experts

The cost is 25 cents, but we mail it free on request with orders of $5 or over, received before June 1.

GRASS SEED OF KNOWN QUALITY

FOR GOLF COURSES, TENNIS COURTS, POLO FIELDS, ATHLETIC FIELDS, AIRPORTS, CAMPUS, LAWNS, ETC.

All our seeds are of the highest quality, botanically true to name and are cleaned and re-cleaned, special care being given to the elimination of weed seeds.

We are always glad to advise in regard to formulas suited to soil and climatic conditions, treatment of soil, fertilizing, etc.

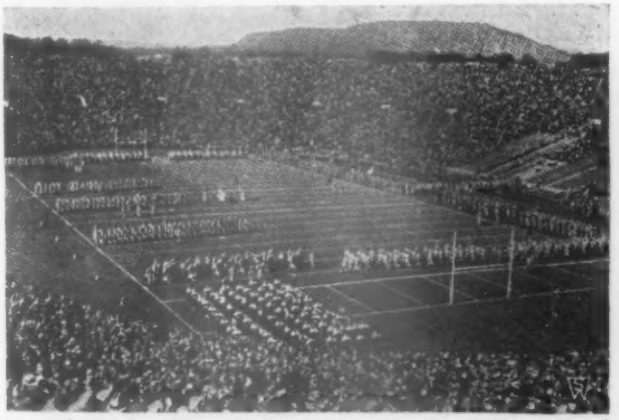
EQUIPMENT AND SUPPLIES

We are also agents and dealers in Tractors, Mowers, Rotary Soil Screens, Implements, Fertilizers, Insecticides and Sundry Equipment and Supplies.

Some of these items are unobtainable at the time this book goes to press, but we welcome your inquiries.

Complete Catalog on Request

Experimental Turf Plots at the Stumpp & Walter Company's testing grounds at Farmingdale, Long Island. Here research work has been carried out with grass varieties, plant foods, mowers and rollers



The Yale Bowl at New Haven, Conn. Grass Seed for Yale Bowl, as well as for Yale Golf Course, Polo Field and Football Field, also for Stadium at West Point, supplied by the Stumpp & Walter Co.

HIGH QUALITY BULBS

We are one of the largest growers and importers of Bulbs for discriminating flower lovers in the United States.

FLOWER SEEDS

All our seeds are of the highest quality and are carefully examined and tested at our trial grounds. We offer only those of superior strains and finest types, and a complete list of new introductions.

VEGETABLE SEEDS

All our seeds are of the highest quality and we list only such sorts which from tests at our trial grounds we have found to be of superior merit and which we can recommend for both the market and home garden.

120-Page 1945 Seed Annual Free on Request

IMPORTANT FOR 1945!

SAWCO-JAPY

(Japanese Beetle Milky Disease Spore Dust)

Destroys the larvae or grub of the Japanese Beetle which causes severe injury to turf in lawns, golf courses, parks, pastures and gardens.

The bacteria causing the "milky disease" are Bacillus Popillee and Lentimorbus. Sawco-Japy (milky disease spore dust) contains at least 100 million viable spores of either or both of the above organisms per gram of product. Write for Prices.

VICTORY GARDENS

The War Food Administration recommends more attention be given to garden projects by schools; also that the subject of practical gardening be given greater importance in the country's educational system.

20,000,000 Better Victory Gardens Needed in 1945. This is 1½ Million More Than 1944!

ECLIPSE LAWN MOWER COMPANY

Factory and General Offices: Prophetstown, Illinois

Eclipse

The World's Best Lawn Mower

Your post-war plans should include Eclipse Power and Hand Mowers. Year after year, Eclipse engineering led the way to greater lawn mower value and superb performance. Our engineers today are doing a leader's work in precision equipment for war. *True to our tradition of leadership, Eclipse lawn mowers will be the greatest value in the victorious days to come!*

Eclipse MODEL L 5-BLADE

The preferred mower for those seeking the finest in lawn mower precision and service. Selected for professional service and by discriminating home-owners with fine lawns.

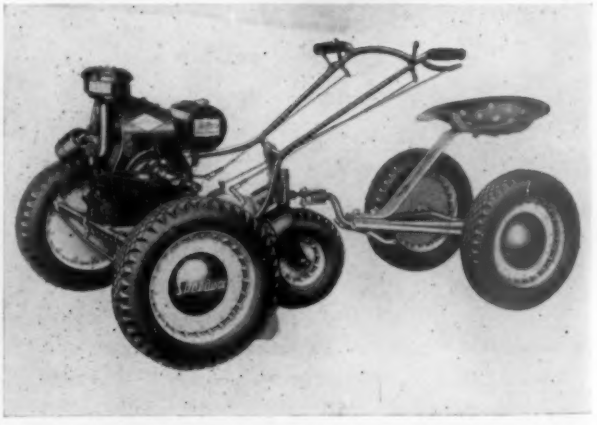
Eclipse PARKHOUND

21" COMMERCIAL POWER MOWER

Eclipse advanced engineering has combined the commercial and professional features usually found on larger, more expensive mowers, to meet the severe requirements of professional cutting.

A new brisk power action with that solid dependable handling ease — a feat of brilliant performance that will save you upwards to 50% in operating economy.

Geared to the present-day mowing standards, with that built-in staying quality.



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THE UNIVERSAL PUBLIC GROUNDS MOWER

World's fastest power lawn mower. The outstanding value in its field. The "built-in" stability with speed added. Cuts a 32" swath 150 feet long every 15 seconds — 600 feet per minute actual stop-watch timing with positive operation control.

Speed doubled — Acreage doubled — Fastest perfect cutting power lawn mower ever built. New high speed cuttings.

Eclipse Natural Grip all-steel handles assure positive mower control with ease not possible with other type handles

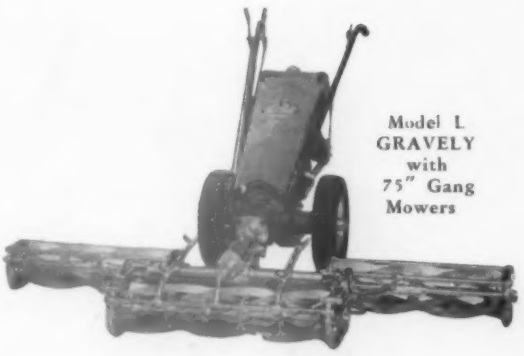
GRAVELY MANUFACTURING COMPANY

Box 252, Dunbar, W. Va.

Model L GRAVELY with Vee-Type Snow Plow

Schools and universities throughout the country recognize the distinct advantages of the GRAVELY—the **only** machine that solves so many upkeep problems.

1. **Mows Your Lawn**
2. **Cuts Tall Weeds and Grass**
3. **Removes Snow**



Model L GRAVELY with 75″ Gang Mowers

A YEAR-ROUND MACHINE

You buy ONE sturdy 5 H. P. Tractor . . then, change **power** attachments according to the job. With the GRAVELY **one** man does everything. . . .

A 30-inch Power Driven Rotary Mower for the lawns (power-driven gang units and riding sulky available for the larger areas) . . . a Power Sickle Mower for the rough spots and athletic fields. . . . A power sprayer . . . A Power Pump . . . A cart for moving dirt . . . or odd jobs of hauling. . . . Both Vee and a Patented Reversible Blade Type Snow Plow capable of working in 12″ of snow. Whatever the job, if you own a GRAVELY you have the equipment and sufficient power to do it.

FRUITS OF SPECIALIZATION

The GRAVELY is produced in a factory devoted to manufacturing nothing else. This includes making the motor as well. Each manufacturing operation is controlled. This means that each machine is produced as a complete unit, each part **designed** to be used with the others . . . **not an assembling proposition.**

The GRAVELY products are sold **and serviced** through Dealers, for all GRAVELY Dealers are qualified to render service on the machines they sell. Write us that you may check with our representative in your neighborhood. Like the product, you will find our sales policy practical . . . you are not asked to buy a machine without first being shown what it will do,—under your very own conditions.

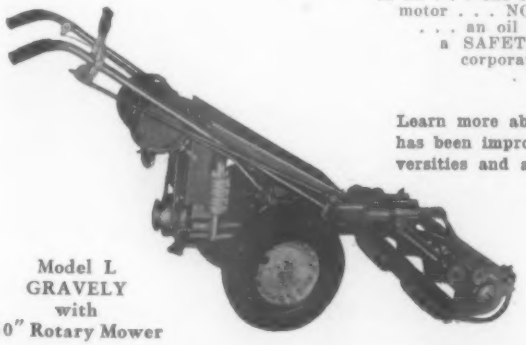
EXCLUSIVE GRAVELY FEATURES

There is a 5 H. P. motor . . . **two** forward and reverse speeds . . . an automotive type differential . . . a worm gear drive running in oil . . . one spot lubrication system for both tractor and motor . . . NO CHAINS . . . an oil bath air cleaner . . . an oil filter to clean and strain the oil . . . a SAFETY SLIP CLUTCH individually incorporated into each power attachment . . . and many, many others.

Learn more about a machine that for TWENTY years has been improving the appearance of schools and universities and at the same time reducing upkeep costs.

Ask for our catalog entitled:

"MAKING AND KEEPING A BEAUTIFUL LAWN"



Model L GRAVELY with 30″ Rotary Mower

Model L GRAVELY with 42″ Sickle Mower

PIONEER GEN-E-MOTOR

5841 West Dickens Avenue Chicago 39, Illinois

PINCOR products

Planned for

RUGGEDNESS

Precision Built for Years of DEPENDABILITY

Right Now!

Pincor Products are weapons of war, but when civilian production is again possible, Pincor will offer Hand and Gasoline Powered Lawn Mowers, Water Systems and Electric Generating Plants. These products have been designed and engineered to meet the rugged requirements of institutional use.

Write now about your needs. Pioneer will be glad to give you information concerning your requirements and present you with a story of the New Pincor Products you may expect—some day not far away.

The mower illustrated indicates possible future trend, not necessarily actual design.

Get Acquainted with PINCOR *products*

INVEST IN WAR BONDS

POWER LAWN MOWERS
HAND LAWN MOWERS
WATER SYSTEMS
POWER PLANTS

PIONEER GEN-E-MOTOR CORPORATION
5841-49 DICKENS AVE., CHICAGO 39, ILL.

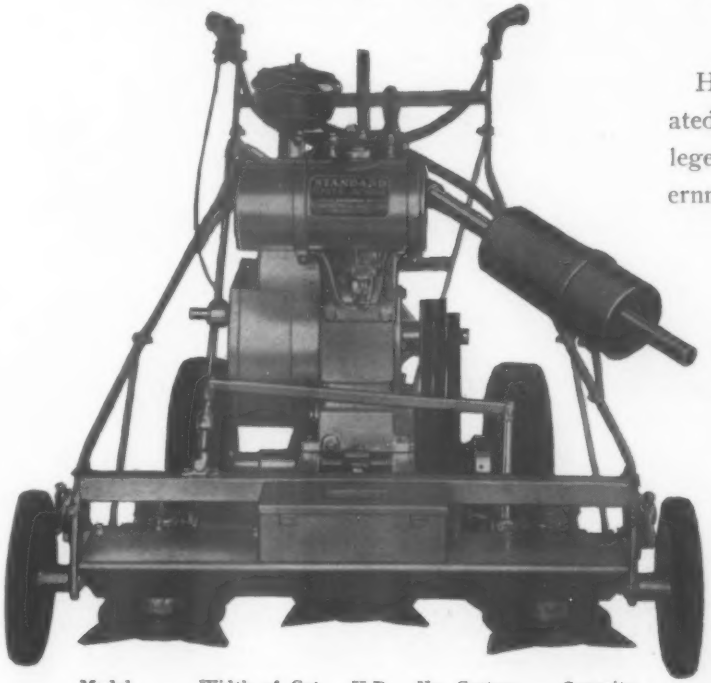
STANDARD MFG. & SALES COMPANY

Lebanon, Indiana

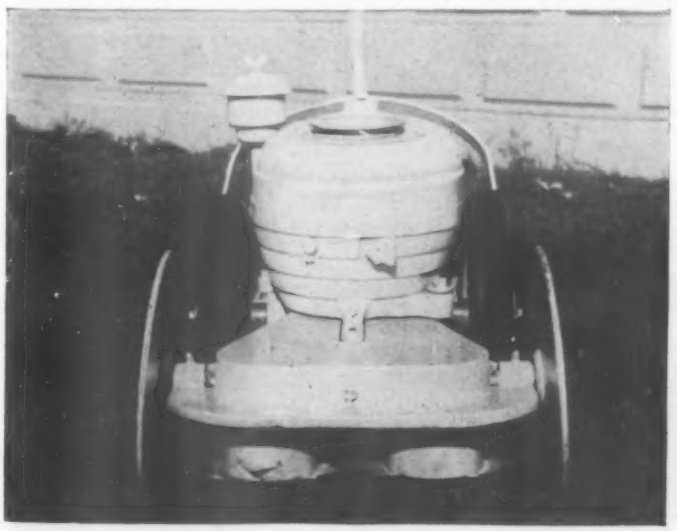
STANDARD POWER MOWERS

Large schools, colleges, parks and estates use STANDARD Power Mowers

Solve Every Mowing Problem



Model	Width of Cut	H.P.	No. Cutters	Capacity
Model A-9	25″	2	2	5- 6 acres
Model AA-9	30″	2	2	6- 7 acres
Model B-9	37″	3	3	7- 8 acres
Model BB-9	48″	4	4	9-10 acres
Model C-9	62″	4	4	10-12 acres



The "Poynter" Mower

A Mower and Attachment for Every Purpose

THE STANDARD ROTARY CUTTER

Has been on the market for ten years, and operated under the hardest kind of service. Used by colleges, parks, schools, large estates, cemeteries, Government facilities, etc. Some individual users have as many as 14 of these mowers in use and are still replacing other mowing equipment with Standard mowers. Standard Power mower has been developed into the most versatile cutting device in the field—cutting lawn-grass, dandelion, buck-horn, Johnson grass or any other standing growth without cumbersome attachments. It will cut evenly at any height; permits high mowing.

Leaf Pulverizer attachment is a long desired solution for your leaf problems. Gathers, pulverizes, disperses leaves as a fertilizer for your lawns.

Mowing in a Big Way—Two 5-foot Mowers and Trailers

An Answer to Your Snow Problems

WRITE FOR FULL DESCRIPTION OF ALL STANDARD EQUIPMENT AND DEMONSTRATION BY LOCAL DEALER

PITTSBURGH PLATE GLASS COMPANY

COLUMBIA CHEMICAL DIVISION

Grant Building, Pittsburgh 19, Pa.

Chicago • Boston • St. Louis • Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte • Los Angeles

COLUMBIA CALCIUM CHLORIDE

For Easy, Economical and Effective

COLUMBIA CALCIUM CHLORIDE

Summer Dust Control

Driveways, Athletic Fields, Other Open Areas

Winter Ice Protection

Walks and Steps, Roads and Driveways

The maintenance staffs of numerous schools have found Columbia's Calcium Chloride exceptionally useful in keeping walks and driveways and other areas safe and in good condition throughout the year.

IN SUMMER — Columbia Calcium Chloride is used to eliminate dust and maintain firm surfaces on roads and driveways, playgrounds, tennis courts, athletic fields and other areas. The Calcium Chloride absorbs moisture from the air, effectively preventing dust and consolidating surface materials.

It is easy and economical to use — merely spread on the area to be treated. The applications can be made manually, or for larger areas, mechanical methods of spreading are available. In general, only two applications per season are required — one at the outset, and another and lighter application six to eight weeks later. The stabilization of the surface saves re-surfacing costs.

IN WINTER — Columbia Calcium Chloride melts ice from walks and steps, making cleaning easy. Mixed with sand or cinders, it enables the abrasives to become embedded in the ice, presenting a firm, non-skid surface on roads and driveways. The abrasives last longer — don't blow away — lighter and fewer applications are necessary.

COLUMBIA CALCIUM CHLORIDE IS PREPARED IN EASY TO HANDLE FLAKE FORM, PACKED IN 100 POUND MOISTURE-PROOF PAPER BAGS

OTHER COLUMBIA CHEMICALS

CALCIUM HYPOCHLORITE — For convenient and effective sanitation, accomplished by the chlorine released when free-flowing particles are added to water. Used extensively for swimming pool sanitation and for disinfecting solutions for showers, lockers, toilets and other areas subject to contamination. Packed in 5 pound cans and 100 pound drums.

CLEANER AND CLEANSER — In white powder form, specially prepared for general use in all manual cleaning operations — china and glassware, kitchen equipment, etc. Contains no harmful inactive ingredients; dissolves in water rapidly and completely.

COLUMBIA DETERGENT — A carefully blended mixture of the scouring type. Especially suitable for cleaning large areas, such as enameled and painted surfaces, tile and marble walls and floors. Will not scratch or otherwise harm surfaces of this type.

COMPLETE INFORMATION ON REQUEST

Literature containing more complete description will be furnished on request, together with prices and the name of your nearest distributor.

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 Rector Street, New York 6, N. Y.

BRANCH SALES OFFICES:

BOSTON • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
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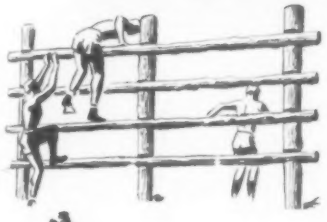
HERE'S EASY WAY TO KEEP ATHLETIC FIELDS DUST-FREE ...AT LOW COST!



Faced with less man power? Short on equipment? Solvay Calcium Chloride can provide the answer to keeping your athletic fields clean, compact and dustless.

Simply apply this material on cinders, clay, bluestone, earth, gravel. *It completely ends dust.* Solvay Calcium Chloride can be applied by anyone—no experience or special equipment is necessary. This treatment is clean, odorless, colorless and non-staining. *Economical* too . . . cost averages only 3¢ to 4¢ per square yard per season!

Used for 25 years by leading schools and universities, Solvay Calcium Chloride is today being used on military reservations, R.O.T.C. drill grounds, Commando Practice areas and for athletic fields.

USED FOR OVER 25 YEARS

For Cleaner, Weedless Dust-free Play Areas, Use

SOLVAY CALCIUM CHLORIDE

WRITE FOR FREE FOLDER TODAY! No charge or obligation. Write to SOLVAY SALES CORPORATION, 40 Rector Street, New York 6, N. Y., or use the postage paid American School and University postcard in the back of this book.

ANCHOR POST FENCE COMPANY

Complete Line of Fences and Playground Equipment

6695 Eastern Ave., Baltimore 24, Md.

SALES OFFICES IN PRINCIPAL CITIES

ANCHOR FENCES FOR SCHOOLS AND SCHOOL PLAYGROUNDS

The Anchor Post Fence Company has been serving public schools and colleges, municipalities and industrial plants with fencing and playground equipment to suit their various requirements for half a century.

Anchor Chain Link Fences

Makers of America's first chain link fence, the Anchor Post Fence Company today manufactures a complete line, and will be glad to supply any interested school executive or architect with a copy of our Chain Link Fence Catalog containing full information about the four exclusive features which make an Anchor Chain Link Fence exceptionally attractive and durable. **Ask for Catalog No. 110.**

Anchor-Weld Iron Fences and Gates

Through the exclusive Anchor-Weld method of construction, the Anchor Post Fence Company is able to manufacture iron fences and gates which equal in appearance many expensive hand-wrought products. Many schools throughout the country are today justly proud of their beautiful Anchor-Weld Ornamental Iron Fences and Gates. Some of these are to be found illustrated in our **Catalog No. 111.**

Anchor Drive-Anchorage

Anchor's Four Exclusive Features

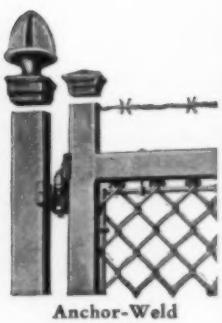
1. **ANCHOR-WELD WIRE GATE**—built with a frame of square tubular steel—arc-welded at the corners. The square shape of the heavy steel tubing, together with the welding of the corners, provides a framework of such exceptional strength that no re-enforcing diagonal braces are needed. We claim that this is the strongest and most attractive wire gate made.

2. **SQUARE TERMINAL POSTS**—stronger because they are square in section. More protective—having no fabric-holding bands and therefore providing no footholds for climbing. Better-looking—because of their graceful lines.

3. **U-BAR LINE POSTS**—made of high carbon steel and U-shaped in section to insure maximum strength.

4. **DRIVE-ANCHORAGE**—grips the soil like the roots of a tree. We have imitated nature's engineering by providing the line posts with a broad foundation. Anchor drive-anchors defy thaws, frosts and the many other strains to which a fence is subjected.

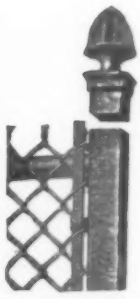
Note: **While we strongly advocate the drive-anchor method of setting posts, we can, if desired, set our posts in concrete footings when conditions warrant such a procedure.**



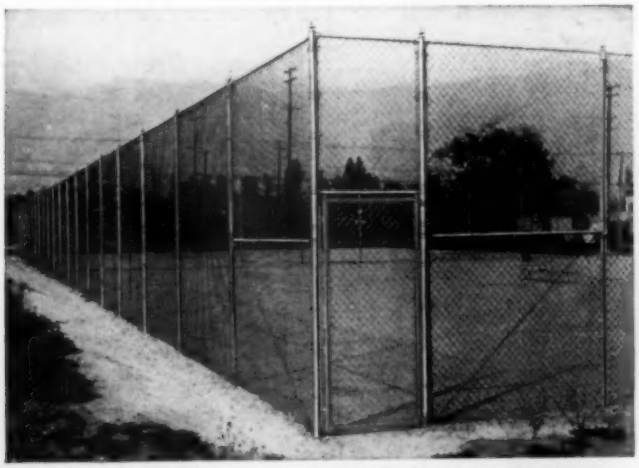
Anchor-Weld Wire Gate

Anchor Chain Link Fence with Top Rail High School, Mineola, N. Y.

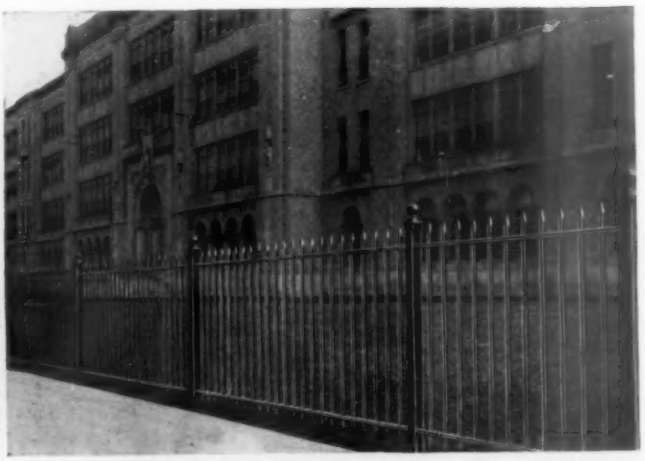
Anchor U-Bar Line Post



Anchor Square Terminal Post



Anchor Chain Link Tennis Court Enclosure at Pasadena High School, Pasadena, Calif.



Anchor-Weld Fence Surrounding St. Anne's School, Fall River, Mass.

CONTINENTAL STEEL CORPORATION

Manufacturers of Chain Link Fence for All Purposes

General Office: Kokomo, Indiana

SALES REPRESENTATIVES IN THE FOLLOWING CITIES

Alexandria, Austin, Atlanta, Canton, Chicago, Columbus, Dallas, Dayton, Des Moines, Detroit, El Paso, Evansville, Ft. Wayne, Grand Rapids, Indianapolis, Kansas City, Louisville, Minneapolis, New Orleans, New York, Norfolk, Oklahoma City, Omaha, Philadelphia, Richmond, San Antonio, South Bend, St. Louis, St. Paul, Toledo, Tulsa, Wichita

COMPLETE CHAIN LINK FENCE

To meet the fencing requirements of schools and universities, Continental has developed a wide range of structural variations in its Chain Link fence. The selection in styles, heights, types of top construction, gates and accessories makes it possible for schoolmen to select the best fence for any installation.

MADE OF KONIK STEEL

FABRIC OF KONIK STEEL*

The wire fabric in Continental Chain Link fence is made of KONIK—a new steel containing copper, nickel and chromium for greater strength and rust resistance "clear through." This superior fence fabric carries a zinc coating applied by a special hot dip process to insure uniformity and adhesion of the coating to the base steel. A uniform, bright finish enhances the appearance of Continental fence fabric. Wire is full gauge and woven in exact mesh.

*NOTICE: *War needs come first, but if you need fence protection now, write to Continental. Regulations change and we may be able to supply your needs. Effective April 30, 1941, Continental Steel Corporation complied with OPM Order No. M-5 and discontinued adding nickel to steel used for Chain Link except where specified on a Government Order.*

12 STYLES

Continental offers 12 styles of top construction for Chain Link fence. Six popular styles are illustrated to the right. Continental fence is engineered for each specific job.

POSTS AND FITTINGS

Continental fence has heavier, sturdier posts with improved brace construction. Top rails are joined by a special Inside-Outside coupling. Post caps and barbed wire arms are sturdy, heavier. Self-locking slots hold barb wire. New type lock pin eliminates bolts and nuts for fastening fabric to tension bands.

GATES

Strong and easily operated gates and locking devices. Single and double types with improved pivot type hinges. Manually or mechanically operated.

ENGINEERING AND ERECTION SERVICE

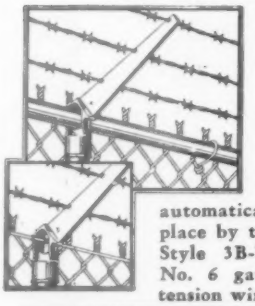
Our engineers are prepared to assist you in laying out the most economical installation for your purposes. Trained erection crews are available for correct and economical construction anywhere. When local labor is used Continental will supply competent foreman and inspection service.

SEND FOR FREE MANUAL

This file size book contains more than 100 illustrations, will help you evaluate fence protection, select right style of fence. Write the

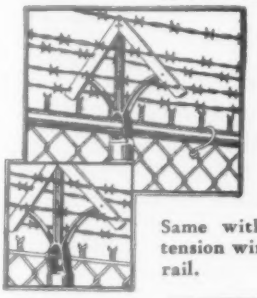
CONTINENTAL STEEL CORPORATION
KOKOMO, INDIANA

A STYLE TO MEET EVERY SCHOOL NEED



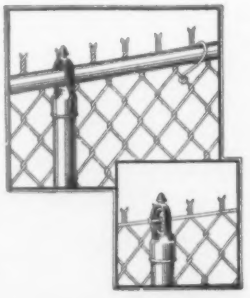
Style 3B - R—Three strands of barb wire with top rail. Arm of 12 gauge pressed steel. Barb wire held in angle slots and automatically locked in place by tension.

Style 3B-W—Same with No. 6 gauge coil spring tension wire instead of top rail.



Style 5B - R—Five strands of barb wire with top rail. Top rail of tubular steel 1⅝" O.D. Has 7" expansion sleeves.

Style 5B - W—Same with No. 6 gauge tension wire instead of top rail.



Style NB - R—No barb wire with top rail.

Style NB-W—Same with No. 6 gauge tension wire instead of top rail.

CONTINENTAL SUPERIOR STEEL

CONTINENTAL *CHAIN LINK* FENCE

OTHER CONTINENTAL STEEL PRODUCTS > STEEL ROOFING AND SIDING · FIELD FENCE · GATES · POSTS · BARBED WIRE · NAILS · LAWN FENCE · ETC. MANUFACTURER'S WIRE · GALVANIZED AND SPECIAL COATED SHEETS · BILLETS · SHEET BARS · WIRE RODS

CYCLONE FENCE DIVISION

(American Steel & Wire Company)

UNITED STATES STEEL

General Office: Waukegan, Illinois

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Fort Worth, Texas

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Greensburg, Ind.
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United States Steel Export Company, New York

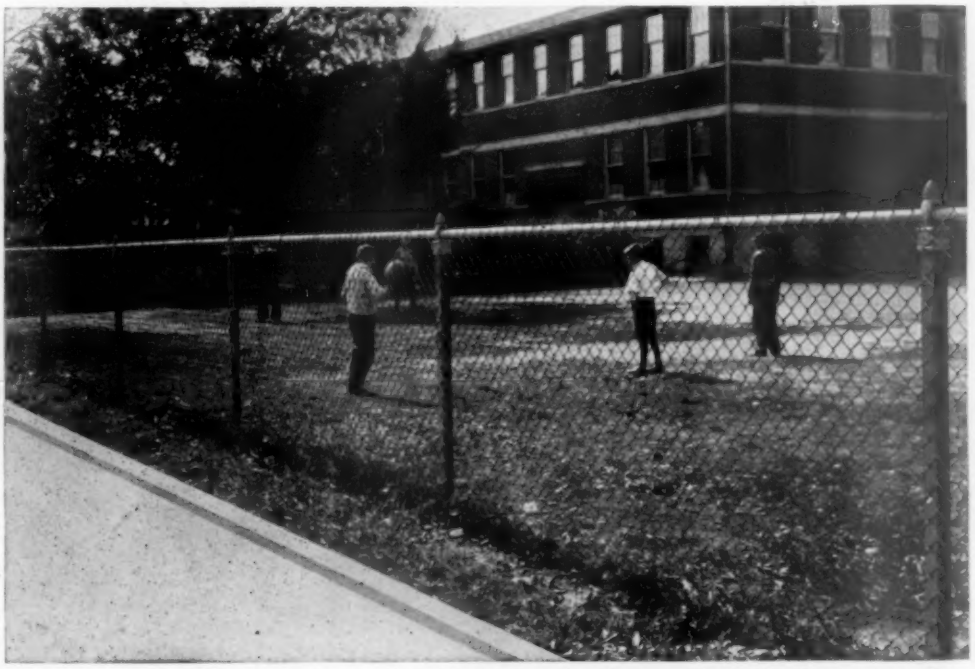
CYCLONE FENCE is the economical, serviceable enclosure for school yards, playgrounds, athletic fields, outdoor pools. For years Cyclone has specialized in fencing school property. Cyclone Fence is the recognized standard for every school and playground purpose.

School grounds enclosed with U·S·S Cyclone Fence provide maximum protection for your school children.

Athletic fields fenced with Cyclone get more paid admissions—for they permit complete control of crowds, efficient collection of tickets.

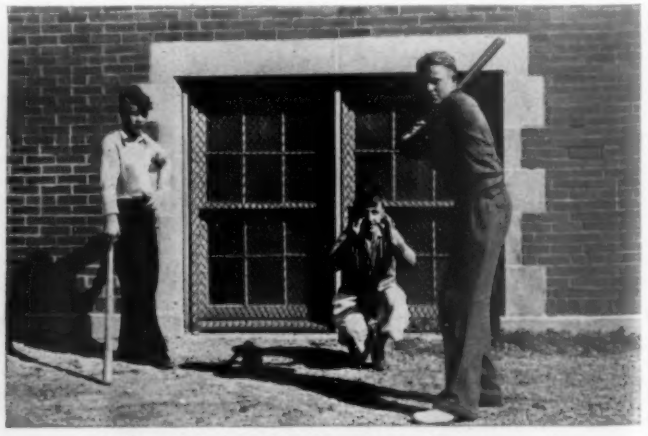
Because of its long, trouble-free service, you will find Cyclone Fence most economical in the long run. In every detail it is made for durability and long life.

Get the facts on Cyclone Fence now. Send for our free booklet: "Your Fence—How to Choose It—How to Use It." The 32-page book is packed with information you will want on Cyclone Fence, Tennis Court Enclosures and Window Guards. Ask for a free estimate. *Also ask for copy of useful folder giving detailed specifications for Cyclone Fence and other Wire Products used for School Properties.*



Cyclone Safeguard Chain Link Fence for School Grounds, Playgrounds, Parks, Institutions, Etc.

Cyclone Invincible Chain Link Fence for Athletic Fields



Cyclone Window Guards are sturdy—save money

THE STEWART IRON WORKS COMPANY

"Fence Builders to America Since 1886" INCORPORATED

1203 Stewart Block, Cincinnati, Ohio

PRODUCTS
Bronze Tablets
Chain Link Wire Fence and Gates
Flag Poles
Folding Chairs
Folding Gates

PRODUCTS
Iron Fence and Gates
Pipe Railing
Settees
Stadium Seat Brackets
Window Guards
Wire Mesh Partitions

FOR EVERY PURPOSE

Stewart offers Plain or Ornamental Iron and Chain Link Wire Fence and Gates for front, side and rear property lines; for athletic fields, tennis courts, recreation grounds and other school requirements.

Stewart Chain Link Wire Fence is the only ALL BEAM FRAMEWORK construction on the market. The Chain Link Wire Fence illustrations clearly show this exclusive feature. Notice the 3TH Oval-Back I-Beam Line Post with integral extension arm. Obviously this solid post is superior to pipe or other types of post requiring a separate pressed steel arm which may be removed or easily broken. Notice, too, that the beam top rail passes through the post itself — eliminating the need for fittings. The flat, smooth surfaces of Stewart All Beam construction offer maximum resistance to wear, weather and corrosion. This type of fence structure, exclusive with Stewart, is the heaviest and strongest manufactured.

Style 0TH Chain Link Wire Fence

Style 3TH

Usual heights of style 3TH shown in illustration are 7 ft. and 8 ft. overall. All materials are of Copper-Bearing Steel hot-dipped galvanized *after* fabrication to assure greatest possible resistance to rust.

IRON FENCES AND GATES

For front property lines where dignity as well as protection is a requisite, Stewart offers a multiplicity of designs in plain or highly ornate iron. Here again Stewart construction is unique. The patented channel rail, exclusive with Stewart, adds immeasurably to the strength of the fence. All fittings are of Stewart design — the result of more than 56 years' experience and research in the fence building field.

CATALOGS — SALES AND ERECTION SERVICE

Literature is available on all Stewart products. If interested in Chain Link Wire Fence ask for Catalog No. 79. If in Iron, ask for Catalog No. 81. When requesting catalogs, please indicate products in which you are primarily interested.

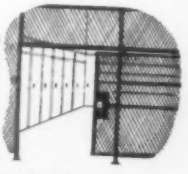
Stewart maintains sales and erection offices in all principal cities. Consult your local classified telephone directory or write direct to factory.

METAL FOLDING CHAIRS

Built of strong steel channels. Full size seat with correctly pitched form-fitting back. Stewart Metal Folding Chairs are tip-proof. Standard finishes are: Black, Brown, Dark Green, Mahogany or Taupe. Literature and prices furnished upon request.

WIRE PARTITIONS

Effective and economical enclosures for locker rooms, stock rooms, supply rooms, toolrooms, machinery, power houses, etc. When writing for prices please send sketch giving measurements.



BACKSTOPS

Ideal for hard or soft baseball diamonds, tennis and badminton courts, etc. Sturdily constructed to stand the toughest abuse. Literature and prices furnished on request.

BRONZE PLAQUES

Plaques and tablets of hand-chased cast bronze, are available in stock sizes from 9″ x 16″ to 24″ x 36″. Special sizes will be made to order. Literature and prices gladly sent on request.

PITTSBURGH STEEL COMPANY

Grant Building, Pittsburgh 30, Pa.

PITTSBURGH CHAIN LINK FENCE

Better in Every Part

Only Pittsburgh Chain Link Fence has all of the quality features specified here, such as tubular posts and top rail, malleable outside fitted post caps, beveled tension bands, adjustable barbed wire arms, superior gate fittings and genuine copper-bearing steel galvanized after weaving. Quality is insured by Pittsburgh Steel Company's control of every process of manufacture, from ore to the finished fence. You can have this superior complete fence quality at no extra cost.

"Pittsburgh" Products

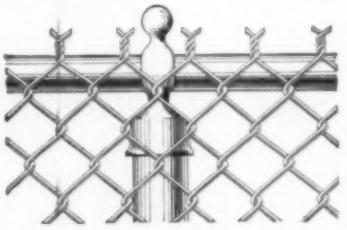
Other Pittsburgh Steel Co. products of interest to School, Municipal and Public Works authorities include Pittsburgh Safety Highway Guard; Wire Reinforcement for pavements, walks and buildings; Pittsburgh Steeltex for Floors, and Pittsburgh Steeltex for Plaster, Partitions, Suspended Ceilings, Stucco and Masonry Veneer; Farm, Poultry, Ornamental Lawn and Special Industrial Fences.

CHAIN LINK FENCE SPECIFICATIONS

Pittsburgh Guardian Chain Link Fence
(Standard Heavy Construction)

Standard height, 6 ft. Built in heights from 5 ft. up to and including 12 ft. In all heights chain link fabric is full height of fence.

Fabric—Pittsburgh Chain Link copper-bearing basic open hearth steel wire, hot galvanized after weaving with heavy zinc coating. No. 6 and No. 9 gauge wire woven in 2-in. mesh. Selvage: both edges have a twisted and barbed finish. Fabric under standard specifications carries a heavy coating of zinc and withstands six one-minute immersions by the Preece Test and meets or betters A.S.T.M. specifications.



12-minute Test Galvanizing—*For the finest quality fence fabric specify Pittsburgh Chain Link Fence with galvanizing which withstands 12 full one-minute immersions by the Preece Test.*

Line Posts—2½-in. o.d. copper-bearing steel pipe, weight 3.652 lb. per ft.; or 2¼-in. H-section, weight 4.10 lb. per foot. Special construction in 5 to 8-ft. high fence, with 2-in. o.d. line posts set 30 in. deep in concrete, is available.

Top Rail—1⅝-in. o.d. copper-bearing steel pipe, weight 2.272 lb. per ft. Top rail may be omitted.

Terminal Posts—End and corner posts 3-in. o.d. copper-bearing steel pipe, weight 5.79 lb. per ft.

Swing Gate Posts—3-in. o.d. copper-bearing steel pipe, weight 5.79 lb. per ft. for single swing gates up to and including 6-ft. opening, and for double swing gates up to and including 12-ft. opening.

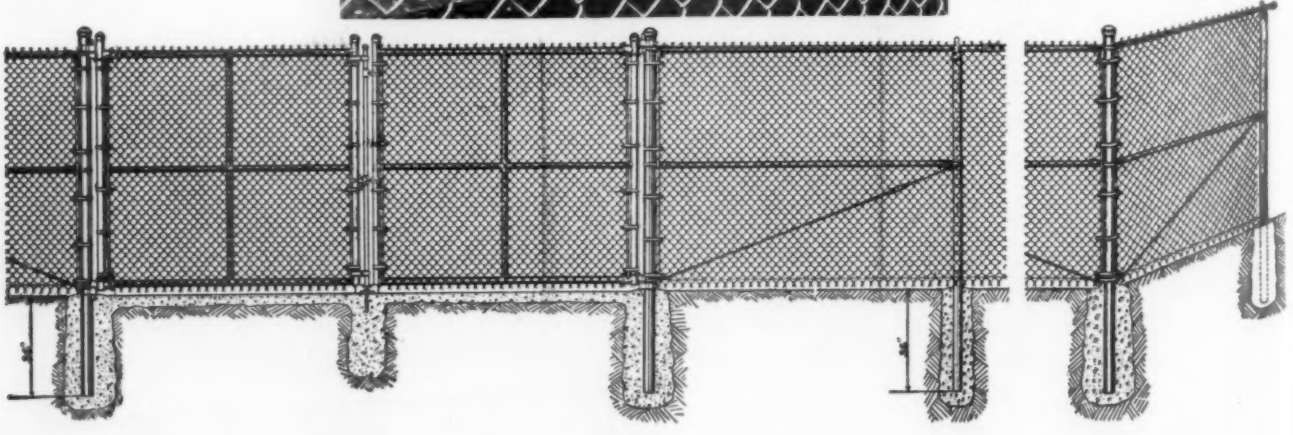
4-in. o.d. copper-bearing steel pipe, weight 9.10 lb. per ft. for single swing gates wider than 6 ft. up to and including 13-ft. opening. Also, for double swing gates wider than 12-ft. opening up to and including 26-ft. opening.

6⅝-in. o.d. copper-bearing steel pipe, weight 18.97 lb. per ft. for single swing gates wider than 13 ft. up to and including 18-ft. opening. Also for double swing gates wider than 26 ft. opening up to and including 36-ft. opening.

8⅝-in. o.d. copper-bearing steel pipe, weight 24.7 lb. per ft. for single swing gates wider than 18-ft. opening, and for double swing gates wider than 36-ft. opening.

Post Spacing and Setting—Posts are regularly spaced in line of fence 10-ft. center-to-center and set 36 in. deep. In all cases posts are set in concrete footings (1:2:4 mix), crowned to shed water and protect post at ground line. Diameters of footings are 12 in. for terminal posts, 10 in. for line posts where fence is 7 ft. and over and 9 in. for line posts where fence is 6 ft. high.

Bracing—End, gate and corner posts are suitably braced with 1⅝-in. o.d. horizontal copper-bearing steel pipe braces,



weight 2.272 lb. per ft., and adjustable truss brace between terminal post and first line post, complete with fittings. Swing gate posts furnished with auxiliary side braces where conditions require. Bracing not furnished on 5-ft. high fence with top rail.

Post Tops—Made of heavily hot zinc coated malleable iron, designed to fit over post top to exclude moisture.

Tension Bars—¾x¼-in. tension bars, secured to terminal post with bands. Hot zinc coated.

Brace and Tension Bands—Made of heavy stampings of the latest approved type, hot zinc coated.

Fabric Bands—No. 6 gauge aluminum alloy of new improved self-tying design, eliminating unsightly buckles.

Gates—Made of 2-in. o.d. hot zinc coated copper-bearing steel pipe, weight 2.717 lb. per ft., with necessary intermediate braces of 1⅝-in. o.d. copper-bearing steel pipe, weight 2.272 lb. per ft. For special construction fence (2-in. o.d. line posts) gate frames used are 1⅝ in. o.d.

Gate Filler—All gates to be filled with fabric to match fence line.

Hinges—Latest type improved heavy duty ball-and-socket design, permitting 180° gate swing, centering gate weight at ground line, eliminating gate sag and preventing turning of hinges on posts.

Latches—Heavy duty plunger-bar clevis type, designed for positive padlock locking.

Ask about Stainless Steel Guardian Fences.

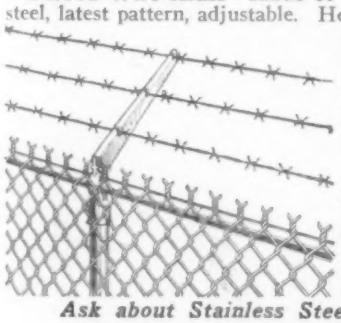
Pittsburgh Custodian Chain Link Fence

(Standard Heavy Construction)

Standard height, 7 ft. over all. Built in heights from 5 ft. up to and including 13 ft. In all heights Chain Link Fabric is 1 ft. less than over-all height of fence.

Construction is the same as Pittsburgh Guardian Chain Link Fence, except that three strands of barbed wire are mounted on adjustable barbed wire arms attached to each line post. Special construction 5 to 8-ft. high fence, with 2-in. o.d. line posts set 30 in. deep in concrete, is available.

Barbed Wire Arms—Made of malleable iron and pressed steel, latest pattern, adjustable. Heavily hot zinc coated. Arms carry three strands of barbed wire—the top strand at an angle of 45°, 12 in. in or out of the fence line; or the arm may be adjusted to vertical position if desired.

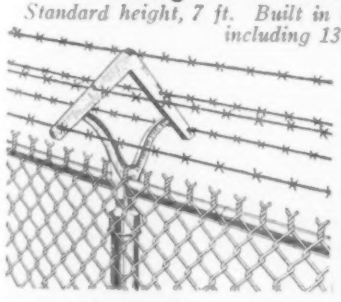


Barbed Wire—Four-point pattern, comprising two strands of No. 12½ gauge copper-bearing wire—heavily hot galvanized, with aluminum alloy barbs spaced 3 in. apart.

Ask about Stainless Steel Custodian Fences

Pittsburgh Chieftain Chain Link Fence

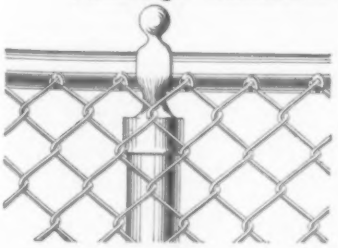
Standard height, 7 ft. Built in heights from 5 ft. up to and including 13 ft. In all heights chain link fabric is 1 ft. less than overall height of fence.



Construction throughout is the same as Pittsburgh Custodian Chain Link Fence, except top finish, which comprises 5 strands of barbed wire and barbed wire extension arms as issustrated here.

Ask about Stainless Steel Chieftain Fences.

Pittsburgh Residential Chain Link Fence



Standard height, 4 ft. Built in heights 3, 3½, and 4 ft. In all heights chain link fabric is full height of fence.

Construction same as Pittsburgh Guardian Chain Link Fence shown on the previous page, with the following exceptions:

Fabric—Pittsburgh Chain Link copper-bearing basic open hearth steel wire, hot galvanized after weaving with heavy zinc coating. Furnished regularly in 2-in. mesh, No. 9 gauge. Also available in No. 6 gauge or No. 11 gauge. Selvage: one edge finished in barbed and twisted, other edge in knuckled finish. Recommended practice is to dress knuckled edge at top of fence just under top rail as illustrated. Fabric carries the full maximum coating of zinc that can be successfully bonded to the specified gauge of wire and meets or betters A.S.T.M. specifications.

Line Posts—2 in. outside diameter steel pipe, copper-bearing, weight 2.717 lb. per ft.

Top Rail—1⅜-in. outside diameter steel pipe, copper-bearing weight 1.678 lb. per ft.

Terminal Posts—End and corner posts 2½-in. outside diameter copper-bearing steel pipe, weight 3.652 lb. per ft.

Gate Posts—2½-in. outside diameter copper-bearing steel pipe, weight 3.652 lb. per ft. No bracing is required because of top rail. If top rail is not used terminal posts are furnished with braces.

Post Setting—Line posts are set 24-in. and terminal posts 30-in. deep in concrete footings (1:2:4 mix), crowned to shed water and protect post at ground line.

Gates—Residential gate frames are made of 1⅝-in. outside diameter copper-bearing steel pipe, weight 2.272 lb. per ft.

Note: Residential fence can be furnished with either lighter or heavier framework. Please write for further information.

Ask about Stainless Steel Residential Fences.

Pittsburgh Chain Link Tennis Court Fence

Heights—8, 10 and 12 ft. in one width of fabric. Heights greater than 12 ft. furnished in two panels.

Fabric—No. 11 gauge, 1¾-in. mesh; selvage knuckled top and bottom.

Posts and Framework—Same as for Guardian Fence.

Gates—Standard Tennis Court Gates are 7-ft. high by 3½-ft. opening (walk); or 10-ft. opening (double drive) with overhead transom. This fence is in every detail, except for the slight difference in mesh and weight of fabric, the equivalent of the Pittsburgh Chain Link Fences previously described.

Note: Tennis Court Fence can be furnished with lighter framework. Please write for further information.

All Pittsburgh Complete Chain Link Fences are designed and manufactured to meet or exceed the most rigid requirements, including A.S.T.M. specifications.

Ask about Stainless Steel Tennis Court Fences.

Miscellaneous Construction

In connection with complete Pittsburgh Chain Link Fences, such items as removable panels for transformer station enclosures; overhead-track slide gates, manually or mechanically operated; baseball backstops and fence end fans are available in standard designs. Special cantilever gates and special construction of all kinds can be supplied on estimate.

Erection Service

An erection service is available everywhere for Pittsburgh Chain Link Fence, either under direction of Pittsburgh Steel Company erection superintendents or the thoroughly experienced crews of our distributors. If you prefer to have your own workmen install the fence, an erection superintendent to direct them will be furnished at a reasonable charge.

Diagram, Prices and Information

When writing for information and prices, may we suggest that you send a diagram of the proposed job. If possible, send blue print with correct measurements and specifications.

Note: All weights and dimensions are nominal and are taken from full standard weight schedule adopted by manufacturers.

Other Pittsburgh Chain Link Fabrics

Pittsburgh Chain Link fabric, made throughout to the high Pittsburgh standards of quality, comes in a wide range of gauges, meshes and fabric widths. Stainless Steel Fences are also available.

Other fabrics for fur farming fences, window guards, partitions, panels, flexible belting, etc., are available—ranging from the heavy fence fabrics to smaller meshes and light gauges for special purposes.

WICKWIRE SPENCER STEEL COMPANY

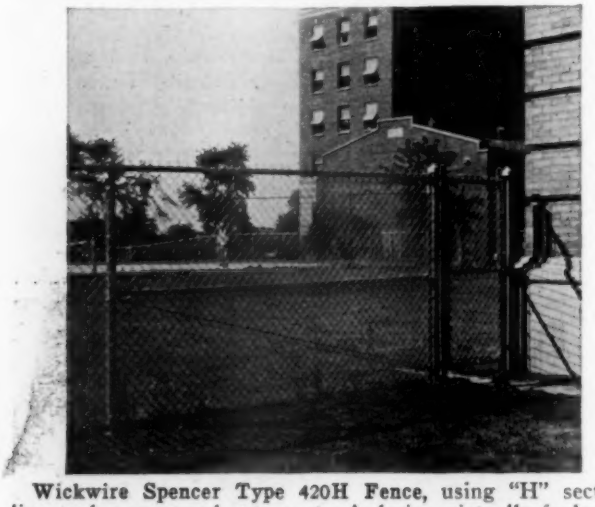
General Sales Office (Fence Dept.), Rand Building, Buffalo 3, N. Y.

DISTRICT SALES OFFICES

New York City Chicago Worcester San Francisco Los Angeles Seattle

DISTRIBUTORS AND ERECTORS IN ALL PRINCIPAL CITIES

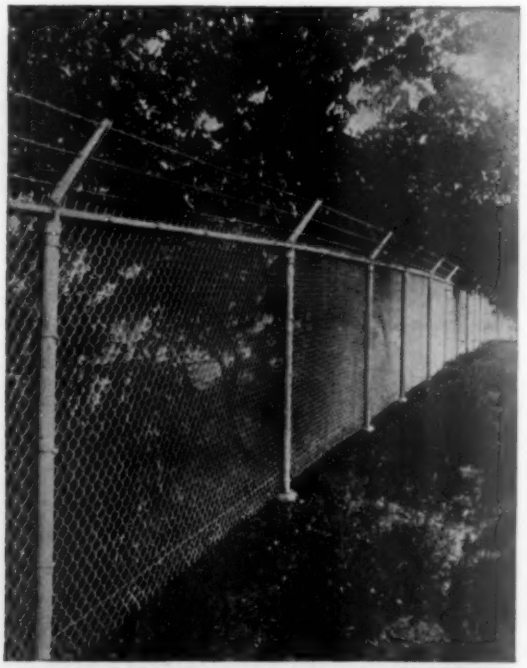
THE Wickwire Spencer Steel Company offers Chain Link Fences for all types of property, including schools, playgrounds, athletic fields, tennis courts, etc. Manufactured entirely in their own plants with complete control from mine to consumer. Sold with complete installation, or if preferred, we will furnish all necessary materials to be installed by others or with the services of a supervising foreman. All posts are furnished to set in concrete footings. (Concrete preserves the metals from corrosion below the surface.) All materials except non-ferrous metals are hot galvanized after fabrication.



Wickwire Spencer Type 420H Fence, using "H" section line, end, corner and gate posts. A design virtually foolproof as no bolts or nuts are exposed for possible tampering. Gates of similar construction using heavy square tubing with specially reinforced heavy hinges and locking devices. If desired, this type of fence is available with copper bearing pipe posts throughout.

Wickwire Spencer Tennis Court Design. Illustration shows a typical Tennis Court Fence design. Two types are available—310 (light construction) and 420 (heavy construction). Standard heights, 8′, 10′ and 12′.

Wickwire Spencer Type 425 Fence. Same as Type 423, except that five strands of barbed wire are used, supported by a triangular arm.



Wickwire Spencer Type 423 Fence with three strands of barbed wire. Illustration shows pipe posts throughout. Gates to match. This type is also available with "H" posts same as shown in Type 420H illustration, with gates of similar construction.

Write to this office direct, or to any of our district offices shown above, for catalogs, and full particulars. Distributors may be located near you. Ask us who they are. Estimates and engineering services will be furnished without any obligation on your part.

JOHN E. LINGO & SON, INC.

ESTABLISHED 1897

Manufacturers of
Metal Flagpoles

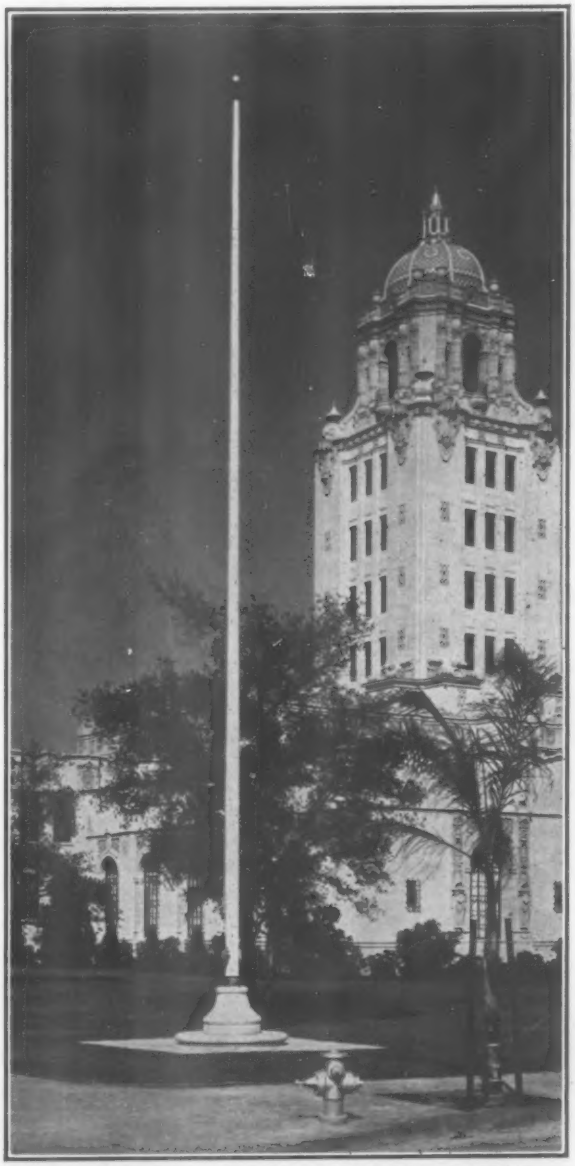
Telephone: CAMDEN 487

29th Street & Buren Avenue
Camden, New Jersey

LINGO TUBULAR STEEL FLAGPOLES

NOW AVAILABLE • FOR PROMPT DELIVERY • WITHOUT PRIORITY

AFTER THREE YEARS of producing thousands of tubular pole products for the Armed Forces, LINGO is again ready to deliver tubular steel flagpoles.



50 Feet Above Grade, Continuous Straight Tapered Heavy Type Steel Flagpole, City Hall, Beverly Hills, Calif.

Because of wartime restrictions all types are not yet available but we can now offer a fairly complete line. If you will send for our 12-page illustrated pamphlet and indicate approximate pole height desired we will be happy to give you full particulars regarding availability, delivery, cost, etc.

TWO DISTINCT TYPES OF STEEL FLAGPOLES

Continuous Straight Tapered Steel Flagpoles (illustrated at left) are standardized in lengths from 20 ft. to 200 ft.; have a smooth uninterrupted exterior surface throughout, without visible joints or offsets, and resemble a finished wood flagpole in appearance. Swaged Sectional Steel Flagpoles (illustrated at right) are standardized in lengths from 15 ft. to 200 ft.; fabricated in sections of standard weight pipe with hydraulic die-swaged, telescoped and shrunk joints, made without the use of bolts, rivets, pins, screw couplings, lead calking, etc.

PLAN NOW

Helpful information for your present and future planning is contained in our new 12-page illustrated pamphlet. A copy is yours for the asking. Our staff is now ready and willing to work out any of your flagpole problems. Temporary wood flagpoles installed for the Duration, or those erected prior to the War, should be replaced at the first opportunity by a "LINGO" steel flagpole. Inspection of Your Present Flagpoles Now May Save Lives Later!

AMERICAN FLAGPOLE EQUIPMENT COMPANY

215 West 155th Street, New York 30, N. Y.

GROUND SET

Continuous Tapered or Sectional. Overall length 25 to 150 feet

TILTING POLE

With two embedded supports. Overall length 25 to 60 feet

STEEL FLAGPOLES

10′ TO 200′ HIGH

AND EQUIPMENT

GROUND SET Flagpoles of this type are made in both sectional and continuous-tapered styles. Either type can be provided with cross arms bolted to the pole or to a box structure surrounding the pole.

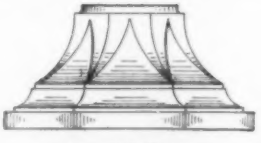
TILTING In this type, the butt of the pole is positioned between two upright supports partly embedded in concrete. Two bolts hold the pole in position. When the lower bolt is removed, the upper bolt acts as a pivot permitting the pole to be tilted.

CONTINUOUS TAPERED This type is fabricated of seamless copper-bearing steel, without visible joints, seams or offsets. Tapering is uniform from butt to top. Diameter of butt: 5 to 20 inches. Diameter of top: 3 to 6 inches.

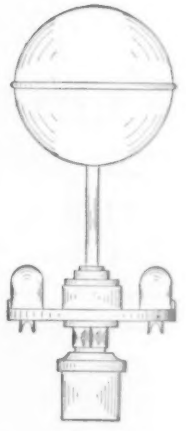
SECTIONAL This type (with a tensile strength of 70,000 to 90,000 pounds per square inch) consists of a series of telescoping sections of seamless copper-bearing steel, each section swaged and shrunk to the next so that joints are air- and water-tight. Poles are shipped complete or in several sections to be welded together when erected.

Large stock on hand for prompt shipment.

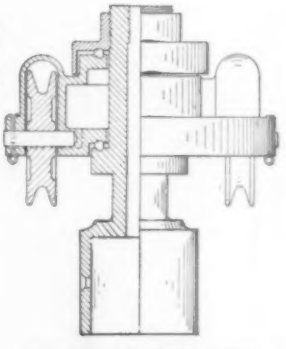
No. 101 Base
For 7⅝-inch pole. Diameter 18 inches. Height 8½ inches



No. 104 Base Octagonal
For 9⅝-in. pole. Diameter 30 inches. Height 14 inches

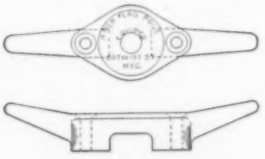


Single Ball - Bearing Truck
For poles with top 4 to 6-in. diameter

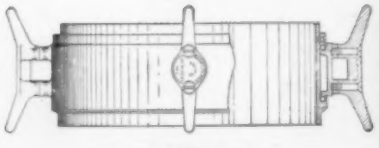


Heavy Double-Ball-Bearing Truck
Waterproof, in bronze only, for metal poles 82 to 150 feet long with top diameter from 4 to 8 inches

. . Catalog Sent on Request . .



9-inch Cleat
Cast iron (painted or galvanized) or bronze



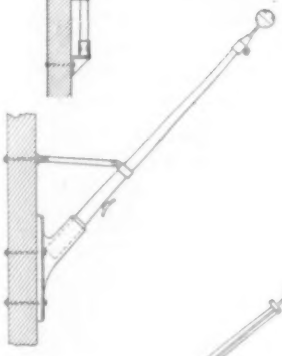
Revolving Cleat
Four equally spaced cleats on revolving band. For ground poles only, from 6⅜ to 16-inch diameter at point attached

Engineering Service To meet the present demand for variations in flagpole and mast construction, we shall be glad to cooperate in developing equipment to meet specific requirements. Our engineering service includes the making of shop drawings, the preparation of specifications, and the detailing of instructions for erection and maintenance. We furnish complete equipment—poles, balls, eagles or weather vanes, cleats, halyards, snap hooks, stock bases, outrigger equipment, parapet bases, etc. See our catalog, "Flagpoles and Equipment."

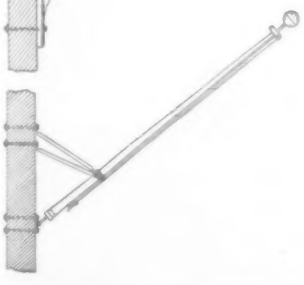
WALL FLAGPOLES

Wall flagpoles, vertical type, parallel to the face of the building, are gaining in popularity. The wall flagpole is inexpensive and easy to install. Resting on an angle seat, it is held firmly in place by two collars anchored to the building wall. Equipped with revolving or stationary truck, gold-leafed copper ball, cleats, halyards and snap hooks. Usual overall length 20 to 30 feet.

OUTRIGGER FLAGPOLES



Socket Base Type This type has a socket base of cast iron or bronze anchored to the building wall and holding the pole at an angle of approximately 45 degrees. The pole is further supported by metal braces extending from wall to pole collar.



Eye Plate Type This type Outrigger is more reasonable in cost than the Socket Base type. The butt of the pole is fixed to a metal eye plate on the building wall, and the pole is further supported by two metal braces extending from the wall to the pole collar.

CONTINUOUS TAPERED

Overall length 14 to 135 feet

SECTIONAL POLE

Overall length 14 to 150 feet

TRAFFIC & STREET SIGN COMPANY

Flag Poles Made of Steel, Copper-Bearing Steel, Stainless Steel, Bronze and Aluminum

78 Foundry Street
Newark, N. J.

FLAG POLE SELECTION

Owing to our many years of experience in handling floodlight, sign, radio or flag pole problems of all kinds, we are able to offer architects and school officials a well-rounded service in planning, detailing and specifying the flag pole and equipment best suited to each individual installation, with due regard to the location factor and to budget limitations.

Our flag poles are made of steel, copper-bearing steel, stainless steel, bronze, aluminum or magnesium. A wide choice of steel flag poles is offered: continuous tapered poles in two types, and telescoped sectional poles in three types—standard, heavy and extra heavy. The flag poles may be ground set, with or without base; roof set, with braces or penetrating roof; or wall set, with a wide variety of supports. We have an unusually wide selection of stock bases, and shall be glad to forward sketches of them. Complete catalog will be sent on request. We are also equipped to fabricate special bases in accordance with architects' sketches.
We suggest that rough sketches of contemplated flag poles be submitted to us, in order that we may prepare details, specifications and estimates. All services offered are, of course, without charge or obligation.

Bloomfield Junior High School
Bloomfield, N. J.

SAFETY NOTE

School architects and purchasing officials are urged to investigate the advantages for safety of steel as opposed to wood in flag pole construction. Wood poles, which to all outward appearance are in good condition, may have rotted inside to a point where they may become the victim of the next strong wind. Furthermore, a good steel flag pole close to a building is an excellent protection against lightning. A steel pole not only safeguards the adjacent structure, but can also be struck by a bolt without danger or collapse.

THE IDEAL WAR MEMORIAL

What more fitting war memorial can be conceived for the school's heroes than a straight tall flag pole, with a plaque at the base commemorating their names and deeds? To those interested in a flag pole memorial plaque, we shall be glad to submit sketches.

THE "CADET" FLAG POLE

The "Cadet" Flag Pole meets the demand for a continuous tapered pole of light weight at a cost within the reach of the small school budget. It has the same construction and proportioning as our standard continuous straight tapered poles, but the height is reduced to forty feet, permitting reductions in wall thickness and weight without sacrificing strength and safety. The "Cadet" gives trouble-free service under all conditions, and is guaranteed to withstand a wind pressure of ninety miles an hour.

CATALOG

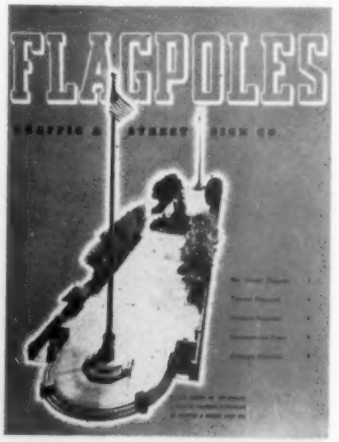
The booklet illustrated below was prepared for the express purpose of simplifying the selection and purchase of the right flag pole for any given building or property. A letter or post-card will bring you your copy by return mail.

★

OTHER PRODUCTS

"Slow," "Caution," "School Zone" signs, parking regulation signs, posts and standards for all types of signs, radio poles, floodlighting poles, etc., are included in the *Traffic and Street Sign Company* line of manufactures. For further information on any of these products, consult *Sweet's Catalog*.

★



THE J. E. BURKE CO.

Fond du Lac, Wisconsin

PLAN with BURKE

For a Complete
Burke-Built PLAYGROUND
SWINGS • SLIDES • SEE-SAWS
CLIMBING STRUCTURES
MERRY-GO-ROUNDS
TURNING BARS • HORIZONTAL
LADDERS • Many Other Items

YOUR post-war plans no doubt include the further development of recreational facilities for your children—the future leaders of your city. You may want to add several new items of equipment, as well as replace old and broken parts.

Why not let us assist you in planning your post-war playgrounds; you'll be assured of the finest equipment money can buy! Burke-Built Playground Equipment has won the approval of park and playground officials throughout the country—it's quality constructed of the highest grade materials.

Designed to give maximum recreation enjoyment in safe healthful play, Burke equipment is built to last indefinitely.

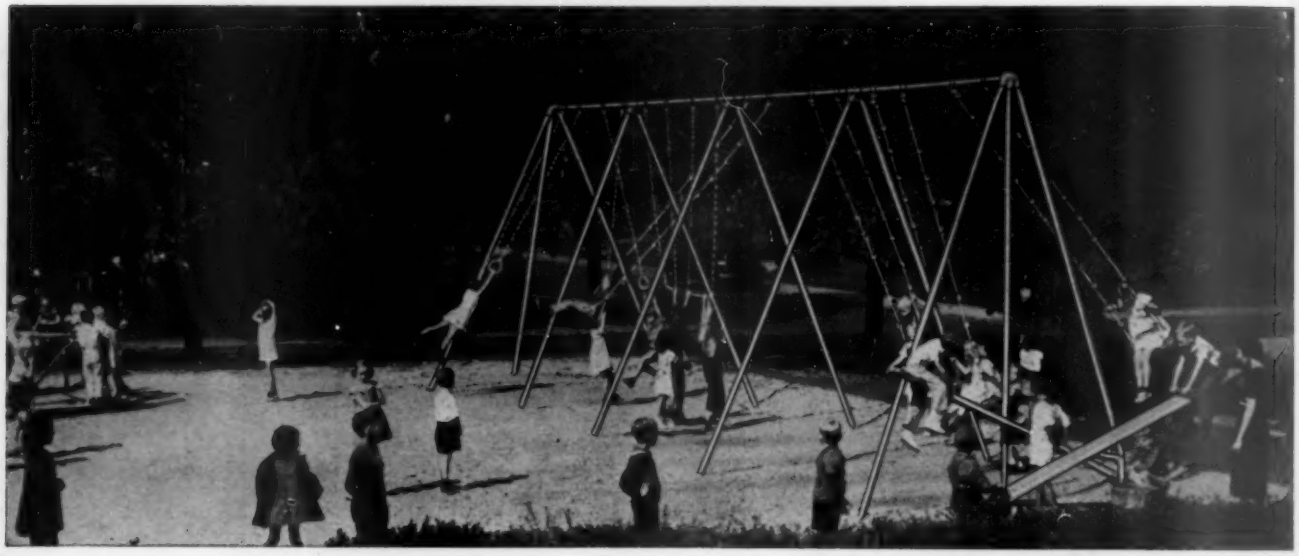
• *Write for our complete catalog and any additional information on items in which you are especially interested.*

The J. E. BURKE CO • Fond du Lac, Wisconsin

AMERICAN PLAYGROUND DEVICE CO.

Anderson, Indiana, U. S. A.

The *Finest* in Playground Equipment — Swimming Pool, Park and Beach Equipment



Approved!

AMERICAN EQUIPMENT FOR YOUR SCHOOL

American Playground Equipment is designed to provide healthful, SAFE play facilities for the *greatest possible* number of children, *without* the need for constant *supervision*

Your entire community looks to you, as its acknowledged *leader* in recreational activities, to provide *safe*, healthful, wholesome *play facilities* for its children . . . to safeguard the physical fitness, the *morale* and the welfare of *tomorrow's* citizens in today's war emergency. You can now select the NEW, dependable *American Physical Fitness Equipment* you need to round out your playground and swimming pool facilities. We urge you to write NOW for illustrated literature on APPROVED American Equipment.

AMERICAN
PLAYGROUND DEVICE CO.
Anderson, Indiana

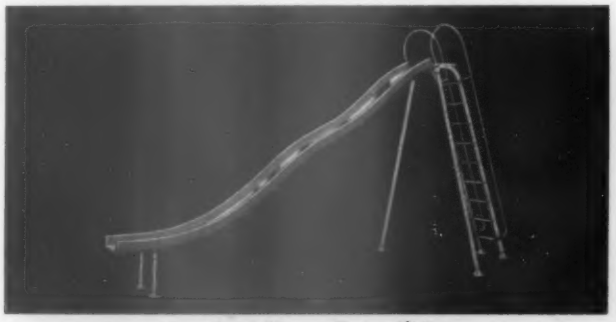
Write for Illustrated Literature	SWING SETS	HEAVY-DUTY SLIDES	HORIZONTAL LADDERS
	CASTLE TOWERS	MERRY-GO-ROUNDS	SEE-SAW OUTFITS
	GYMNASIUM MATS	GIANT STRIDES	COMBINATION UNITS

AMERICAN EQUIPMENT IS FOREMOST IN PERFORMANCE *and* CONSTRUCTION

Our 34 years of *successful* experience has taught us that Playground Equipment *must* be built with *finest* materials and *honest*, skilled workmanship, if it is to give SAFE, dependable, and *permanently* satisfactory service. That is why AMERICAN EQUIPMENT has won nation-wide approval and preference among *leading* educational authorities. NEW materials of *pre-tested* durability are used throughout—*new* steel pipe, extra *heavy duty Certified* Malleable Fittings, rust-proofed by the *hot-dip* galvanizing process—*bolt-through* construction, with no threaded sections to weaken the structure—chain tested to 10 TIMES any possible overload—all combined with clear hardwoods, selected for resistance to stress and strain and weather. Such equipment is the *only kind* any school can really afford.

EQUIPMENT SHOWN BELOW IS APPROVED UNDER THE U. S. OFFICE OF EDUCATION'S VICTORY CORPS PROGRAM

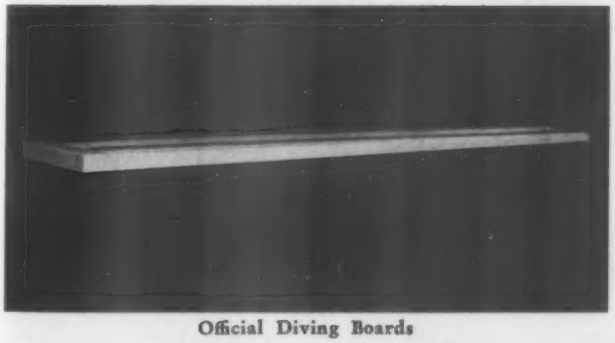
American Steel Swing Sets



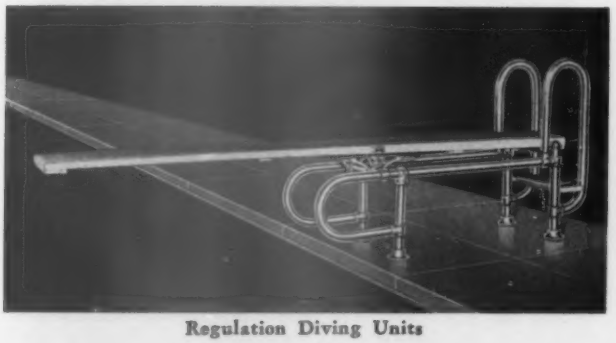
American Heavy-Duty Slides

Horizontal Ladders

Castle Towers



Official Diving Boards



Regulation Diving Units

Send for Literature and Blueprints

ONE-METER DIVING UNITS
OFFICIAL DIVING BOARDS
COCOA MATTING
FOOT BATHS
POOL SLIDES
LIFE GUARD CHAIRS
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POOL LADDERS
WATER WHEELS
HEAVY-DUTY SPRINGBOARDS

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SAFETY
DURABILITY
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THE HEART OF THE ENTIRE RECREATION PROGRAM IS THE CHILD

YOUNG PEOPLE, older than children, too, need recreation and physical exercise. EverWear Recreation Apparatus is built strong and SAFE enough for use by every age.

EverWear Playground Apparatus, EverWear Swimming Pool Equipment and EverWear Basket Ball Backstops will soon again (when the restrictions of war are removed) be serving those whose heart interest lies in furnishing healthful recreation to all who need it. Write now for catalogs, which will be mailed when new ones are printed, after the war is won.

GENERAL PLAYGROUND EQUIPMENT INC.

Kokomo, Indiana

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PLAYGROUND AND SWIMMING POOL EQUIPMENT

Climbing Structures

SWINGS
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OUR PLAYGROUND AND SWIMMING POOL APPARATUS HAS BEEN USED BY THE MAJORITY OF THE LEADING PARKS, RECREATIONAL CENTERS, ATHLETIC CLUBS AND Y. M. C. A.'s FOR MANY YEARS. YOU WILL FIND DESCRIBED IN OUR CATALOG THE LARGEST LINE OF PLAYGROUND AND SWIMMING POOL EQUIPMENT MANUFACTURED BY ONE COMPANY

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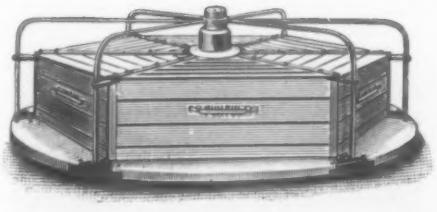
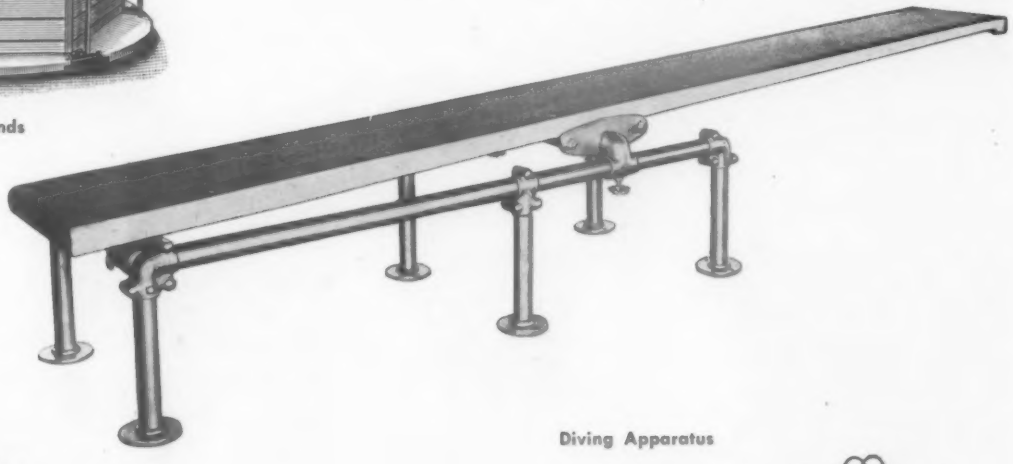
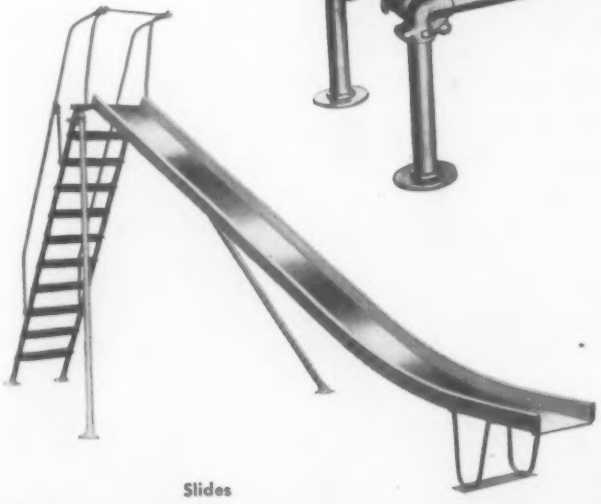


Merry-Go-Rounds



Diving Apparatus



Slides

Combinations

RECREATION EQUIPMENT CO.

724-26 West Eighth Street, Anderson, Indiana

Manufacturers of Playground, Swimming Pool and Basketball Equipment

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Swings, Slides, Merry-Go-Rounds, Gym Combinations, "Monkey-Jungles," Ocean Waves, Horizontal Ladders, Horizontal Bars, Outdoor Basketball Equipment, Giant Strides, etc.

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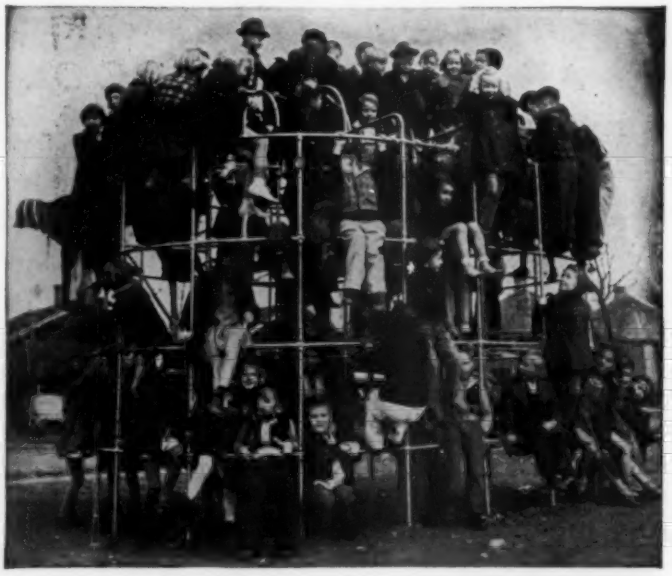

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Diving Board Outfits, Ladders, Pool Cleaning Equipment, Diving Mask Outfits, Foot Trays, Cocoa Matting, Life Guard Chairs, Water Slides, Life Lines, Beach Umbrellas, etc.

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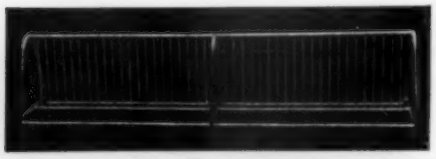
THE FAMOUS "MONKEY-JUNGLE"

The king of all climbing devices. Hot galvanized steel and malleable construction. Strictly modernized. No exposed ends of pipe to catch the clothing. No crude U-bolts. So rigid as to need no corner bracing. We have several other climbing device types, all shipped semi-assembled.



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Made of hot galvanized steel and malleable. Very rugged, and sightly. Several sizes and types. Portable, or made for embedding in concrete.

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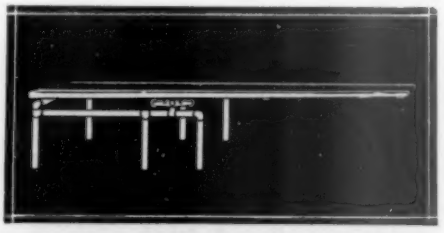

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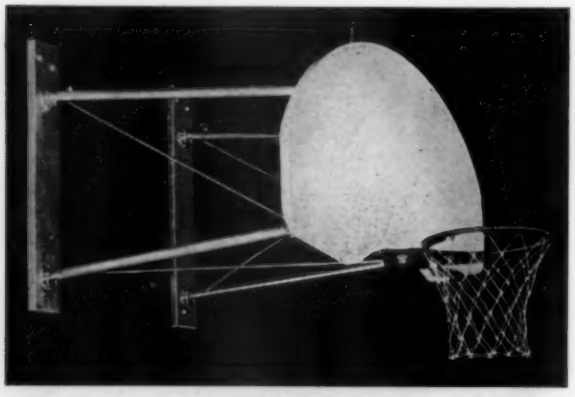
Several types of one-meter and three-meter frames. Noted for their records in the big Championship Contests.



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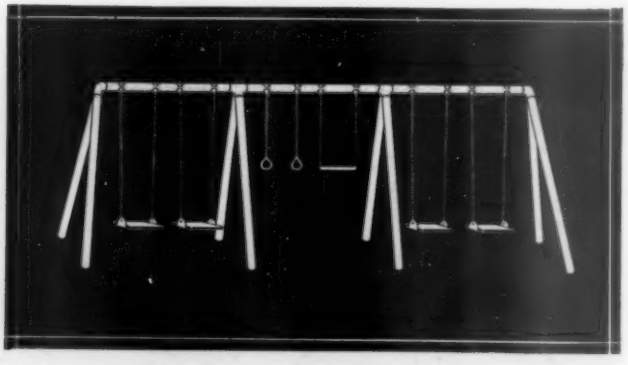
We offer many types of mountings, and backboards. Wall types, portable, and swing-up designs. Official goals. Backboards either fan-shaped or rectangular.



COMBINATIONS

Many arrangements and sizes, using swings, flying rings, trapeze, flexible ladders, slides, etc. Also frames with swings only.

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Established 1869

Manufacturers of Gymnasium Apparatus — Steel Lockers — Storage Cabinets and Shelving

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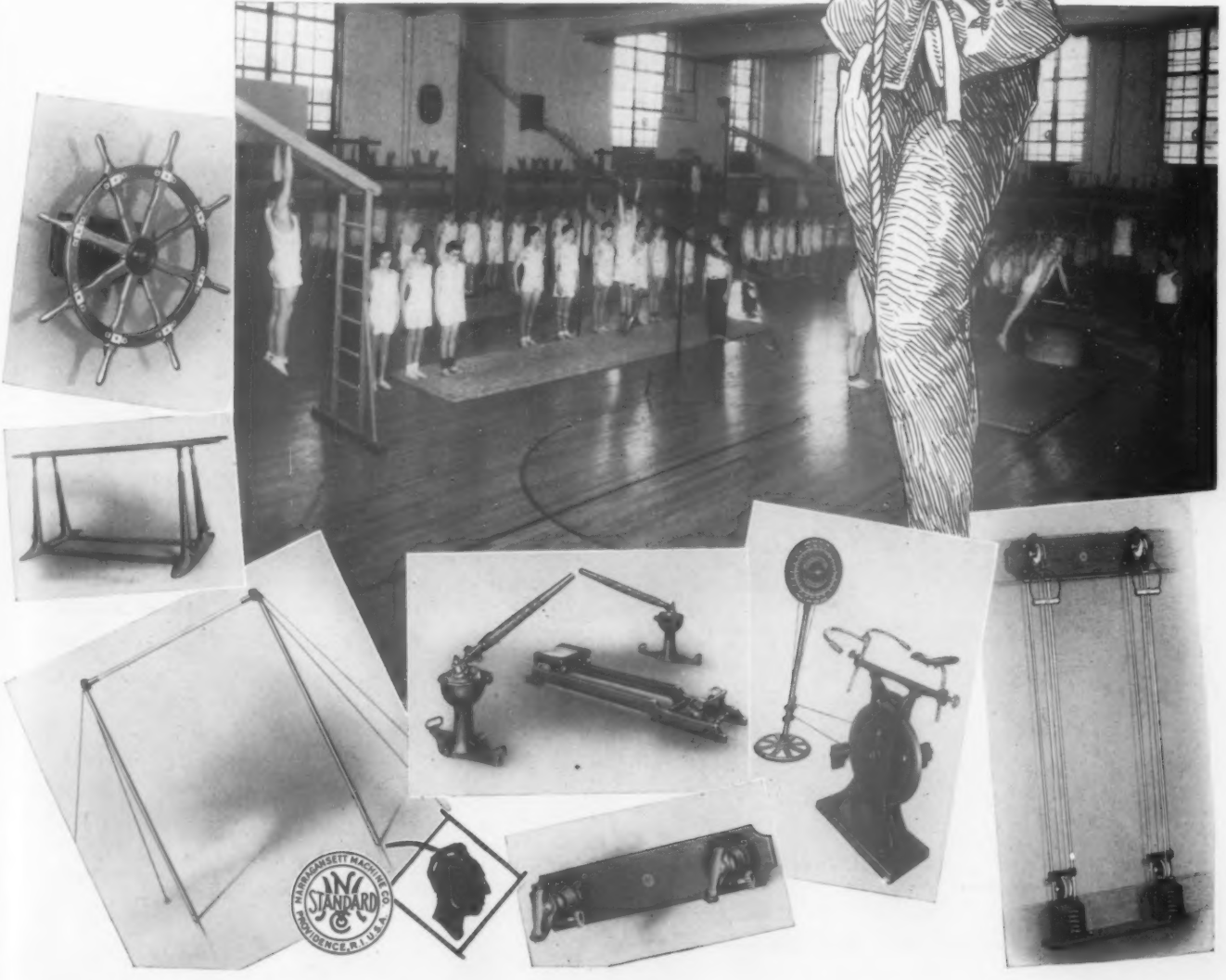
Because They *Could not–*

Many men have lost their lives in this war.

We MUST NOT be found wanting again, due to lack of proper physical training. It is our duty to properly train our youth for the future.

Narragansett Equipment is now standard with the Army, Navy, Marine and Maritime Services . . . in training camps and in service hospitals for rehabilitation work.

In planning for future gyms, let our experts recommend the equipment necessary for a well rounded program. The quality of Narragansett Equipment assures many years of service.



BENJAMIN ELECTRIC MFG. CO.

General Offices: Des Plaines (Chicago Suburb), Ill.

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LIGHTING EQUIPMENT FOR SCHOOL AND UNIVERSITY

Football Field

Tennis Court

Softball Field

WAR PLANT LIGHTING NEEDS HAVE FIRST CALL ON BENJAMIN EQUIPMENT

Lighting being a vital production tool, war plant lighting has priority on all Benjamin equipment. Therefore Benjamin units are available to schools and universities only when such deliveries do not interfere with the Victory effort and are in accordance with priority regulations. However, there are no priorities on planning and, for this purpose, the services of our engineering department are available and yours to command without cost or obligation of any kind. Whatever your problem, be it planning, specification or maintenance — please feel free to call on Benjamin.

Sincerely yours,
BENJAMIN ELECTRIC MFG. CO.

"Play-Area" Senior

"Ellipto-Lite" Play-Area

FLOODLIGHTS

Benjamin "Play-Area" Senior Floodlights, for 750-1500 watt lamps, meet every requirement of football field lighting. They combine in one unit a large open-type porcelain enameled steel reflector with an inner auxiliary reflector of processed oxidized aluminum. Units are finished green outside, white inside. Available with any of following brackets: cross arm for 4¼-inch wood cross arm, cross arm with pipe clamp or with slip-fitter brackets for 1½- or 2-inch pipemasts.

Benjamin "Ellipto-Lite" Play-Area Floodlights are also used extensively in football field lighting. They are of the same general construction as the "Play-Area" Senior but are smaller and less expensive. The 750-1500 watt size is recommended.

"Play-Area" Senior and "Ellipto-Lite" Floodlights also have a wide application in the lighting of baseball fields, softball fields, playgrounds, hockey rinks, swimming pools, stadia, etc.

REFLECTORS

For effective, glareless illumination of gymnasiums, field houses, basketball courts, indoor tracks and rinks, baseball cages, handball courts, etc., the Glassteel Diffuser is recommended. Provides finest quality of soft, well diffused illumination with a minimum of glare. Finished inside and out with white porcelain enamel and supplied in sizes for 150 to 1000 watt lamps.

For the lighting of classrooms and buildings devoted to engineering and vocational pursuits, the Glassteel Diffuser and the RLM Dome are recommended. The RLM Dome Reflector is of porcelain enameled steel and provides good uniform illumination over flat and upright surfaces. Finish is green outside, white inside.

The same equipment recommended for vocational departments is also suitable for laboratories where moisture, corrosive fumes and hazardous atmospheric conditions are absent. For laboratories where explosive hazards are present, a complete line of Explosion-proof and Dust Tight equipment is available; where only moisture and noncombustible fumes are prevalent, "Vapolet" units meet requirements.

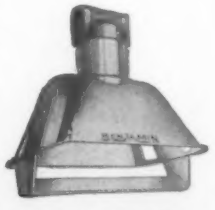
For lighting book stacks in the library or shelves and bins in the store room, the "Stock-Bin-Lite" is recommended. Provides uniform illumination from top to bottom of shelves. Reflectors are of porcelain enameled steel, white inside and out.

FLUORESCENT

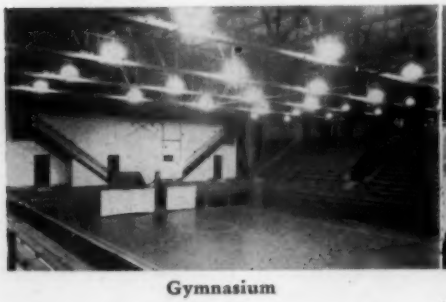
The Benjamin line also includes highly efficient Fluorescent lighting units. Write for complete information.

Glassteel Diffuser

RLM Dome Reflector

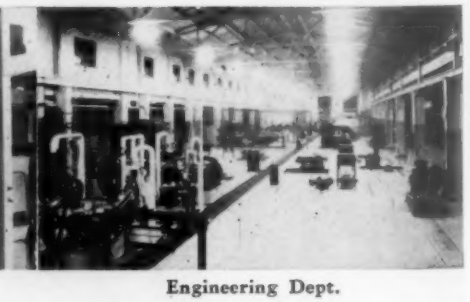


"Stock-Bin-Lite"



Gymnasium

Library



Engineering Dept.

CROUSE-HINDS

ESTABLISHED 1897

Syracuse 1, N. Y., U. S. A.

CROUSE-HINDS FLOODLIGHTS

For Night Sports

Floodlight tipped over for convenient servicing

Type MUA Alumalux

Type ADE-16

Bulletins covering NEMA standard plans for the lighting of Baseball, Football, and Softball Fields are available.

Write for delivery information on the floodlights you need.

Night sports have been increasing in popularity year after year. Almost every sport shows greater attendance at night than during the day, and floodlighting provides increased hours for indulgence in amateur sport and recreation.

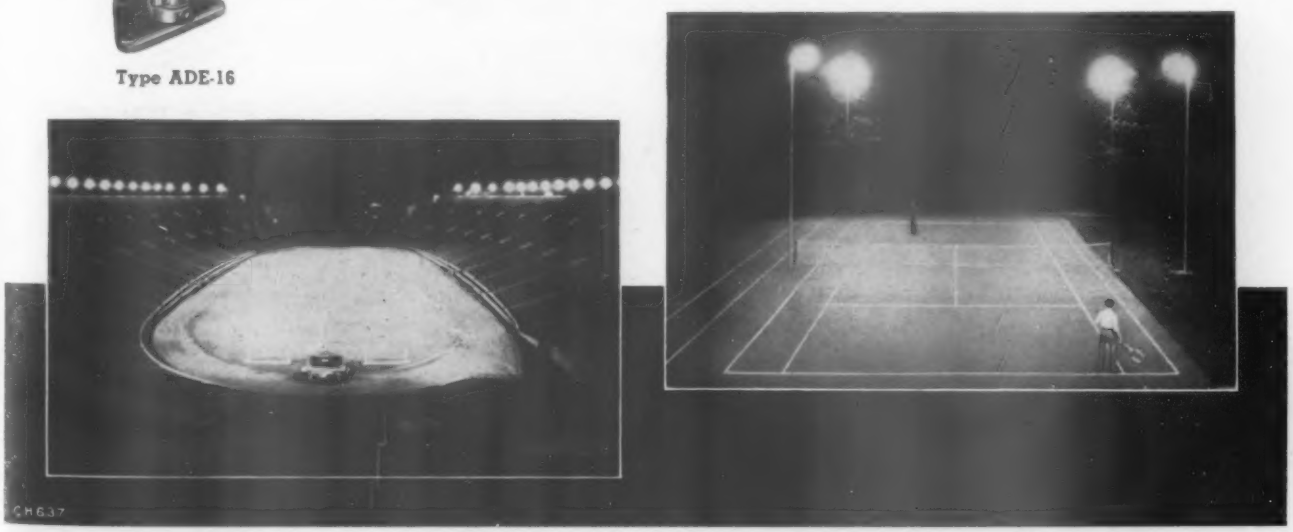
Modern illumination has made night football a most satisfactory game for both players and spectators. Lighted practice fields permit adequate hours of practice which do not interfere with class schedules.

Illuminating engineers have designed lighting systems for almost every kind of sport. Specific plans and descriptions of equipment will gladly be submitted upon receipt of detailed requests.

Type MUA is a general purpose 750 to 1500-watt floodlight which has a complete line of interchangeable and detachable reflectors, and doors.

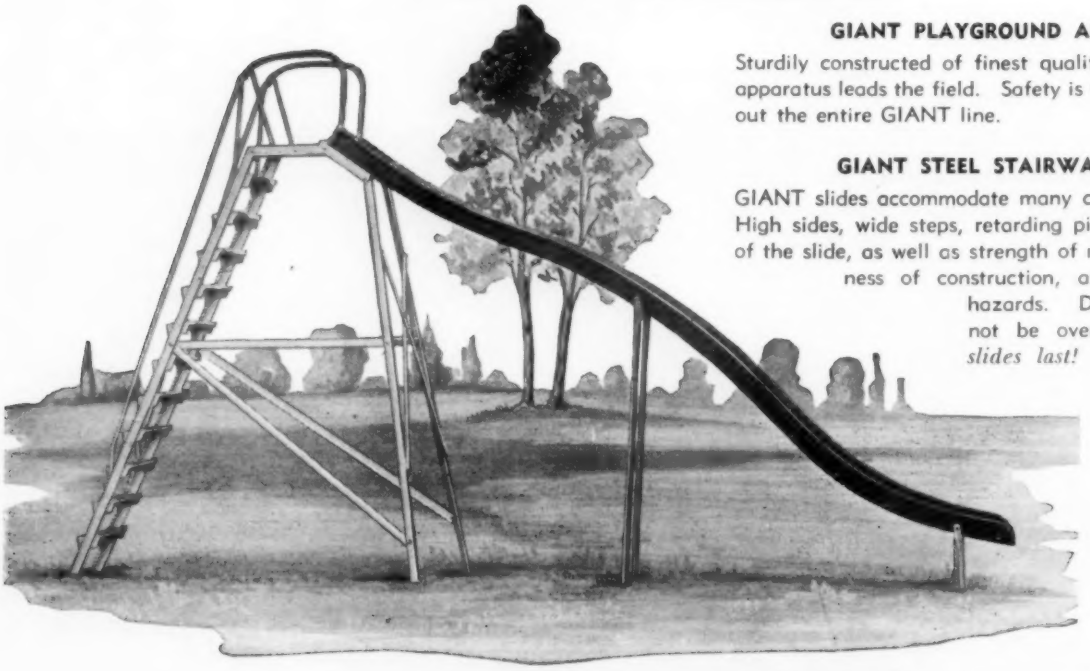
Type ADE-16 is a heavy duty 1000-watt unit of sturdy construction and high efficiency. The unit is dust-tight and weatherproof, and is constructed entirely of corrosion-resisting metal.

Any light distribution desired, from that of a spotlight to the widest spread floodlight, is available.



GIANT MANUFACTURING CO.

Main Office: Council Bluffs, Iowa



GIANT PLAYGROUND APPARATUS

Sturdily constructed of finest quality materials, GIANT apparatus leads the field. Safety is the keynote throughout the entire GIANT line.

GIANT STEEL STAIRWAY SLIDES

GIANT slides accommodate many children at one time. High sides, wide steps, retarding pitch near the bottom of the slide, as well as strength of materials and sturdiness of construction, assure riders against hazards. Durability, too, cannot be overstressed. *These slides last!*

WRITE FOR CATALOG:

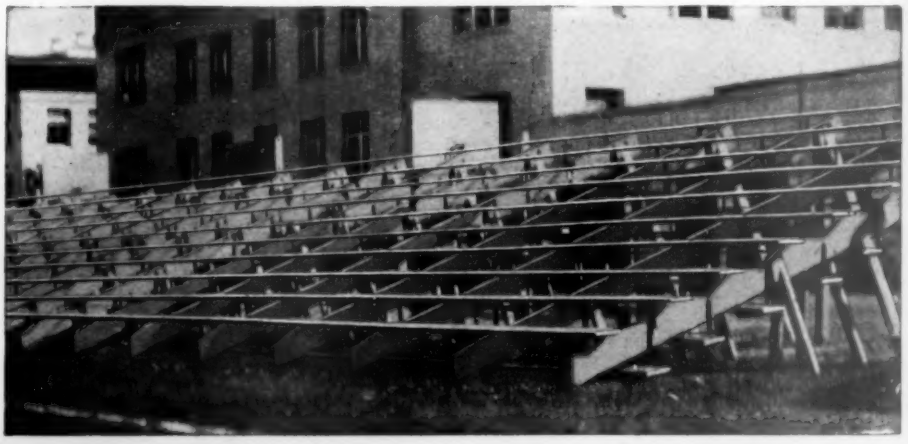
SLIDES
SWINGS
STRIDES
MERRY-GO-ROUNDS
COMBINATIONS
SETTEES
FLAGPOLES

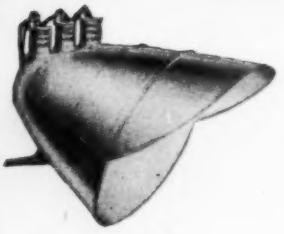
GIANT PORTABLE BLEACHERS

GIANT bleachers are strong, safe, comfortable; made of highest quality, strain-resistant materials; built in sizes to fit any space and give maximum seating capacity. If desired, can be knocked down and stored when not in use. **Last indefinitely.**

GIANT FLOODLIGHT PROJECTORS (Glare Free)

GIANT projectors provide perfect visibility for all night athletics, producing a mellow glare-free light that floods the playing field evenly, eliminating shadows and dark spots. There is a GIANT projector to fill every requirement.





★

DIVING BOARDS AND STANDS,

WATER SLIDES AND POOL LADDERS

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Let GIANT Equip Your Swimming Pool Complete

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A complete line of single, dual and triple socket projectors, mat finish, open or closed type units. *Write for FREE catalog.*

MORE THAN 40 YEARS SERVING THE RECREATION FIELD

THE AMERICAN SCHOOL AND UNIVERSITY—1945

PITTSBURGH-DES MOINES STEEL COMPANY

3425 Neville Island, Pittsburgh, Pa.
Room 994—270 Broadway, New York
1215 First National Bank Bldg., Chicago
924 Tuttle Street, Des Moines, Iowa
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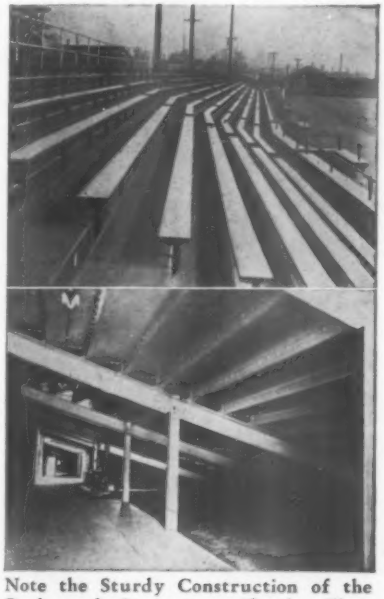
Steel Deck Grandstands

The following information is presented for its usefulness in suggesting a long-range planning program for better outdoor seating. These P-DM products are not available during the national emergency.



Note the Sturdy Construction of the Deck and Supports — Clearly Illustrated in the Two Close-up Views. Substantial Handrails Surround the Stand, and May Also Be Installed to Divide It Into Sections

Pittsburgh-Des Moines Steel Deck Grandstands are used on all types of athletic fields and for indoor arenas. They are built in standard sections 18 feet long by 10 rows deep, each section seating 120 people. A stand may be any number of sections long by any number of sections deep. Its seating capacity may be increased from time to time, double decked if necessary, and no matter how often enlarged it will always present a neat and finished appearance. A roof may be provided over all or a portion of the stand.

The wood seat planks supported on cast iron or welded steel stools are securely bolted down to the deck. Other types of seats are furnished if desired. Aisles, at proper intervals, extend from front to back with walkways along the front or back if necessary. Entrance or exit is accomplished by means of stairs or ramps at the lower end of each aisle, or through wells in the stand.

The steel deck is built to shed water. Hence the space under the stands may be utilized for dressing rooms, toilet facilities, storage, etc. In a number of instances masonry walls have been built along the ends and back so as to totally enclose the space under the stands.

These stands are permanent. They do not weather, rot or decay and therefore will not weaken and collapse. Their first cost is low, and they have a high salvage value. Being assembled by means of bolts, they can be dismantled and re-erected at another location—a feature not possible with other types of construction. An occasional coat of paint, the only maintenance necessary, keeps them looking new year after year.

Write our nearest office for our latest "Steel Deck Grandstands" Bulletin, and any additional information you may desire for future planning.

Louisiana State University Division at Monroe, La. Masonry Enclosure. Seating Capacity, 4000

Southwest Stands — Penn State, State College, Pennsylvania, Seating Capacity, 8160

Waterbury, Connecticut, High School. Masonry Enclosed Sides and Rear. Seating Capacity, 4400

All-Steel Swimming Pools

Summit Hotel, Uniontown, Pennsylvania P-DM All Steel Pool and Accessories

Pittsburgh-Des Moines All-Steel Swimming Pools represent the best value in durability, economy and appearance to be obtained. Lower in first cost than properly-constructed pools of other materials, the P-DM All-Steel Pool requires no maintenance other than a coat of paint at reasonable intervals. It is absolutely watertight; withstands frost action and ground movement without harm; is smooth, sanitary and good-looking for a lifetime. Subject to business conditions, P-DM designs, fabricates and erects steel swimming pools complete with all accessories—under a responsible guarantee of satisfaction. Send for our "All-Steel Swimming Pools" Bulletin No. 402—of value for your reference files.

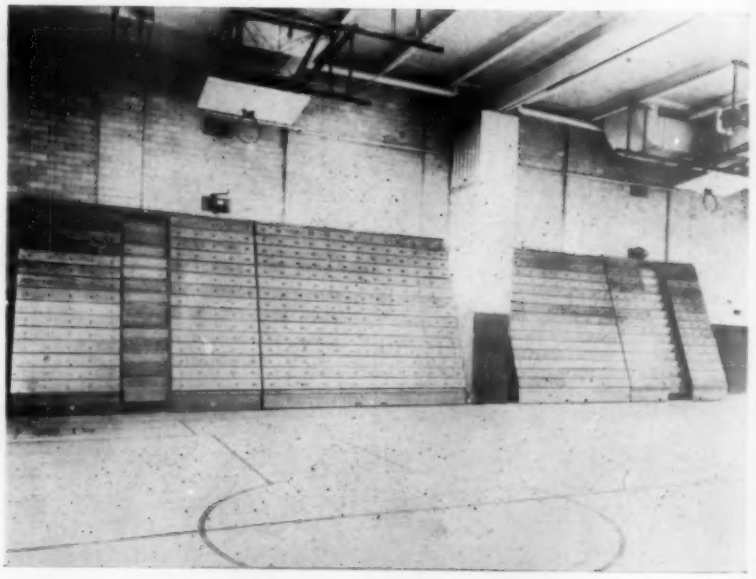
HORN MANUFACTURING CO.

Fort Dodge, Iowa

SALES AND SERVICE FROM COAST TO COAST

Horn FOLDING PARTITIONS AND FOLDING GYM SEATS

The **Horn** folding bleacher is the original telescoping bleacher, operating on the exclusive folding arm principle. This completely eliminates the use of slides and insures trouble-free operation for many years. Wherever seating in a school or public building is used, safety must be uppermost in mind. Therefore in purchasing folding bleacher equipment the skill and integrity of the manufacturer should receive full consideration. Behind the name **Horn** are more than 30 years of manufacturing experience and each product has been manufactured and designed from the standpoint of greater safety, ease of operation, and full value. **Horn** bleachers, like any good product, have been copied in design but have never been duplicated in quality.



16 Row Bleacher and Horn Folding Partition High School, Mahanoy City, Pa.

A FEW OUTSTANDING FEATURES

No riser boards necessary . . . rigid understructure provides ample bracing without their use, resulting in greater comfort for spectators.

Eighteen-inch chair height seats.

Genuine rockite wheels fitted with oilless bronze bearings . . . no chance of rubber oxidation thus insuring longevity of wheel.

Steel X-bracing insures rigidity at all times . . . bleacher cannot get out of alignment.

Load directly on floor at all times.

Automatic locking system locks bleacher in open position. No bolts or rubber pads are used to accomplish locking.

Seatboards automatically tilt to completely close the bleacher when stacked.

No special supports or wall connections are necessary since load is direct to the floor.

Height of bleacher in closed position same as when in use.

Seat and footboards of comb grain Fir with splined ends. All boards not less than 5/4" thick before sanding.

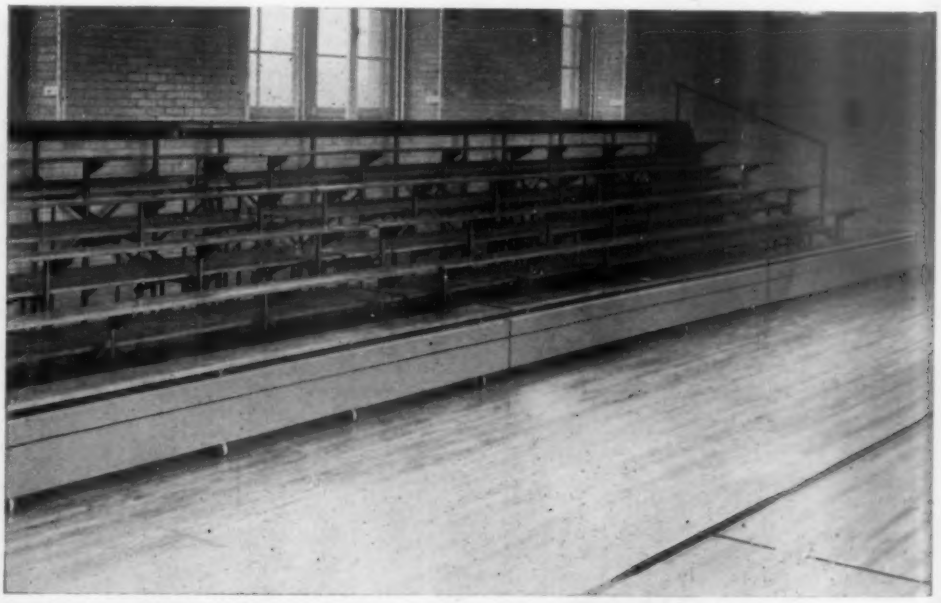
ENGINEERING DATA

Engineering Service

Since it is impossible to catalog all the special information on equipment of this kind, it is suggested that you permit our Engineering Department to prepare the layouts and specifications. This is a service regularly rendered and will not obligate you in any way. Write to Home Office addressing Engineering Department.

COST

For cost estimates send a layout of your gymnasium. Price lists are not published since the cost depends entirely on the quantity involved. The cost of HORN bleachers, however, is less per seat than the cost of ordinary auditorium chairs.



6 Row Bleacher with Guard Rail — Automotive School, New York City

HORN FOLDING GYM SEATS

GENERAL DATA

The **Horn** folding bleacher is the original telescoping bleacher which operates on the exclusive folding arm principle. This completely eliminates the use of slides and insures trouble-free operation.

When the **Horn** bleacher is in the stacked position, seatboards automatically raise to form the enclosure, eliminating necessity of special panels or riser boards.

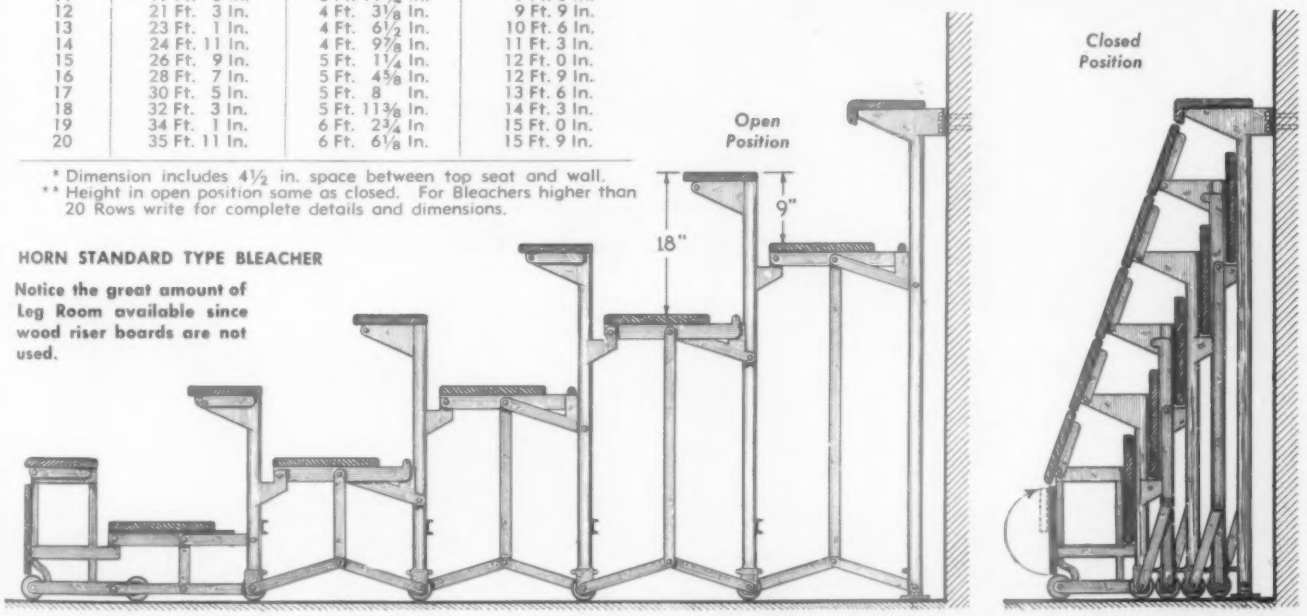
When bleacher is in use, space under the seat affords ample leg room since there are no obstructions under the seatboards. The rise from seat to seat is uniform for all rows and distance from footboard to seatboard is 18 inches.

SPACE REQUIREMENTS—Standard Bleacher

Rows	FLOOR SPACE		** Height
	In Use	* Closed	
3	4 Ft. 9 In.	1 Ft. 8¾ In.	3 Ft. 0 In.
4	6 Ft. 7 In.	2 Ft. 0⅛ In.	3 Ft. 9 In.
5	8 Ft. 5 In.	2 Ft. 3½ In.	4 Ft. 6 In.
6	10 Ft. 3 In.	2 Ft. 6⅞ In.	5 Ft. 3 In.
7	12 Ft. 1 In.	2 Ft. 10¼ In.	6 Ft. 0 In.
8	13 Ft. 11 In.	3 Ft. 1⅝ In.	6 Ft. 9 In.
9	15 Ft. 9 In.	3 Ft. 5 In.	7 Ft. 6 In.
10	17 Ft. 7 In.	3 Ft. 8⅜ In.	8 Ft. 3 In.
11	19 Ft. 5 In.	3 Ft. 11¾ In.	9 Ft. 0 In.
12	21 Ft. 3 In.	4 Ft. 3⅛ In.	9 Ft. 9 In.
13	23 Ft. 1 In.	4 Ft. 6½ In.	10 Ft. 6 In.
14	24 Ft. 11 In.	4 Ft. 9⅞ In.	11 Ft. 3 In.
15	26 Ft. 9 In.	5 Ft. 1¼ In.	12 Ft. 0 In.
16	28 Ft. 7 In.	5 Ft. 4⅝ In.	12 Ft. 9 In.
17	30 Ft. 5 In.	5 Ft. 8 In.	13 Ft. 6 In.
18	32 Ft. 3 In.	5 Ft. 11⅜ In.	14 Ft. 3 In.
19	34 Ft. 1 In.	6 Ft. 2¾ In	15 Ft. 0 In.
20	35 Ft. 11 In.	6 Ft. 6⅛ In.	15 Ft. 9 In.

* Dimension includes 4½ in. space between top seat and wall.
** Height in open position same as closed. For Bleachers higher than 20 Rows write for complete details and dimensions.

NOTE: It is suggested that the top seat be set out from the wall not less than 4½ inches, as otherwise that seat will be decidedly uncomfortable. The space requirement schedule allows for this space. When making comparisons be sure to consider this space.



HORN STANDARD TYPE BLEACHER

Notice the great amount of Leg Room available since wood riser boards are not used.

HORN FOLDING BLEACHERS

SPECIFICATIONS

(1) All folding bleachers shown on the plans shall be **Horn** Accordion Folding Bleachers as manufactured by the **Horn Manufacturing Company,** Fort Dodge, Iowa.

(2) Bleachers shall be installed by factory-trained mechanics and the entire installation guaranteed against faulty materials, workmanship, and operation.

(3) Quantities are as follows: Total length of sections shall be (**specify**) consisting of (**specify number**) rows. When closed, seats shall not extend from the wall in excess of (**specify**). When open, seats shall not extend from the wall in excess of (**specify**).

(4) Bleachers when in use shall be designed and constructed to safely support, in addition to their own weight, a live load of 120 lb. per lineal foot on both seatboard and footboard and a horizontal swaying force applied to the seats of 24 lbs. per lineal foot of seats plus a factor of safety of 4.

(5) Bleachers shall operate on the telescoping principle, whereby all seats fold below the top seat accomplished by means of folding arms. No rollers or slides will be permitted. Units shall be fitted with heavy duty composition rollers to prevent marring floor. They shall be so arranged that any number or all of the seat rows may be extended for use as required. Provide automatic locking equipment which will positively lock the bleachers in open position without the use of bolts or floor sockets.

(6) When bleachers are in a closed position, the seatboards shall automatically rise to an upright position to completely enclose the unit. Provide cylinder locks, keyed alike.

(7) Seatboards and footboards shall be genuine edge grain Douglas Fir, 1¼ in. thick before sanding. Edges of all boards shall be splined to prevent splitting. Woodwork shall be finished with two coats of the best quality of bakelite sealer in a standard color. Steel understructure shall be given two coats of school furniture brown or chrome aluminum.

HORN MANUFACTURING COMPANY, FORT DODGE, IOWA

LEAVITT CORPORATION

206–220 Griggs Street, Urbana, Illinois

KNOCKDOWN BLEACHERS

KNOCKDOWN bleachers as used outdoors

or moved indoors

ADD-A-SEAT stadium
(under construction)

As originators of portable bleacher seating we respectfully solicit inquiries concerning your bleacher needs of all types wood, or steel.

The picture, at the left, presents a view of our ADD-A-SEAT stadium under construction as a War Memorial. Note the rigidity and permanency of structure.

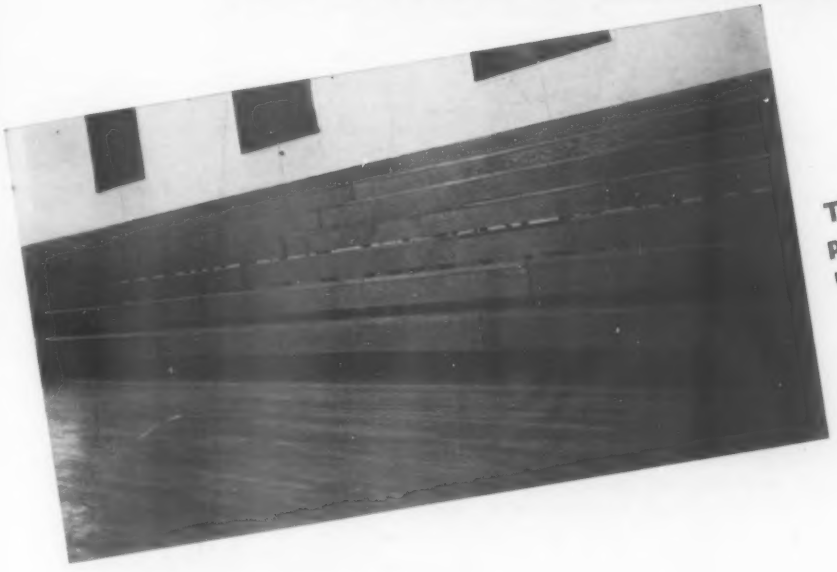
Our gymnasium Telescoping bleachers solve the need for added floor space.

KNOCKDOWN was the first portable bleacher and remains famous for the many safety and comfort features exclusive to its design.

KNOCKDOWN BLEACHERS

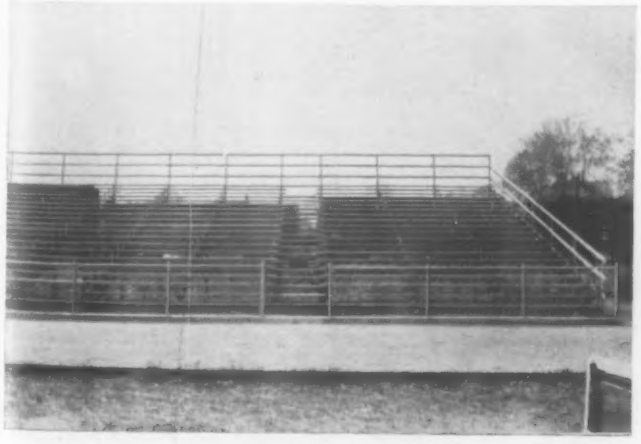
"THEY RISE TO THE OCCASION"

6 Tier provides seats for any occasion



Telescopic type provides greater utility of floor space

ADD-A-SEAT stadium (steel)



A War Memorial that will live

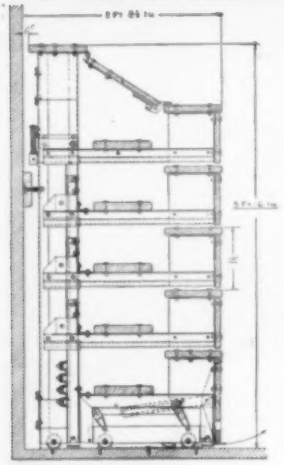
FRED MEDART MANUFACTURING CO.

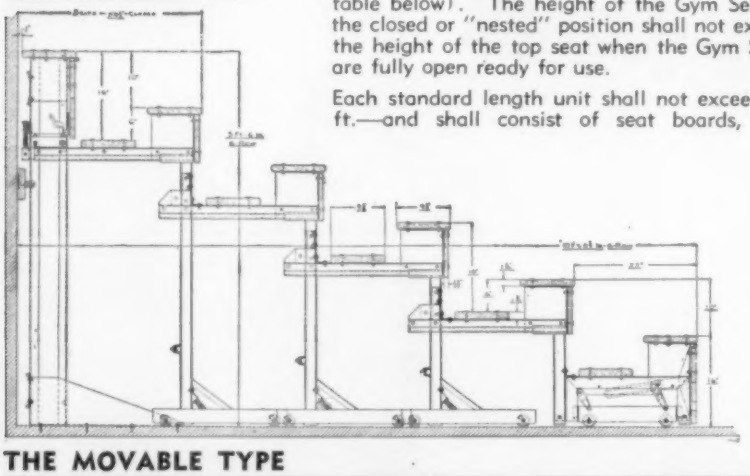
Potomac and Decalb Streets
Saint Louis, Mo.
ENGINEERING AND SALES SERVICE IN ALL PRINCIPAL CITIES

MEDART TELESCOPIC GYM SEATS

Outstanding among the many features of this modern seating is the ease with which seats glide in and out of the "nested" position, in one operation. Use of the telescopic principle eliminates the need for any counterbalance mechanism (springs) and consequently there is nothing to lift up or to pull down; no closure panel and no possibility of any parts of the seat falling on the operator. Understructure is of steel; all wood parts are full length (not pieced) and are of substantial thickness (even the risers are solid, full length selected lumber—no flimsy material used anywhere in the construction). When Medart Gym Seats are installed in a gymnasium it is possible to quickly and easily provide a bench with a comfortable back rest for dances or special classes of instruction by simply withdrawing the one (lower) row of seats from the "nested" position, thus eliminating the need for folding chairs or other auxiliary seating. Medart Gym Seats are fully approved and recommended by the structural engineering department of one of our leading universities as a result of an exhaustive analysis and of actual tests made by these authorities.

THE WALL ATTACHED TYPE





Specifications

As shown on plans and as covered by these specifications, contractor will deliver (and install) the following standard (and special) length units of Medart Telescopic Gym Seats, as manufactured by FRED MEDART MANUFACTURING CO., ST. LOUIS, MO., or the approved equal in the opinion of the architect.

...standard 14-ft. long units, ...rows high
...special ..... long units, ...rows high

Gym Seats shall operate on the telescopic principle, which requires only one operation for opening (or closing) and shall permit one or more rows of seats to be opened for use, while the remaining rows are left in the closed or "nested" position. When closed, Gym Seats shall not extend from the wall in excess of 2 ft. 8 in.; when in open position, Gym Seats shall not extend from wall in excess of .... (see table below). The height of the Gym Seat in the closed or "nested" position shall not exceed the height of the top seat when the Gym Seats are fully open ready for use.

Each standard length unit shall not exceed 14 ft.—and shall consist of seat boards, foot boards and risers (kick boards) of first quality, clear lumber which shall be carefully sanded, finished with rounded corners and bolted securely to steel members. All wood to be stained, shellacked and varnished.

The understructure shall be entirely of steel with uprights or posts of formed steel, double channel construction for maximum strength. Each standard length of seat to be supported by four such uprights or posts which are transported in and out of the closed or "nested" position by means of a multiple of rubber rollers with bronze bushings. When live load is applied, the added weight shall automatically overcome the tension of the compression springs attached to each upright, thus bringing the uprights or posts in direct contact with the floor.

All steel parts shall be finished with two coats of baked-on enamel.

To provide proper circulation of air, steel grilles shall be inserted in the riser (kick board) of the first (bottom) and top row of seats wherever a unit of Gym Seats is placed in front of a heating or ventilating unit. (.... units shall be furnished with grilles.)

Number of rows	Floor space		Height open or closed
	Extended	Closed	
3	4 ft. 6 in.	2 ft. 8 in.	3 ft. 0 in.
4	6 ft. 4 in.	2 ft. 8 in.	3 ft. 10 in.
5	8 ft. 2 in.	2 ft. 8 in.	4 ft. 8 in.
6	10 ft. 0 in.	2 ft. 8 in.	5 ft. 6 in.
7	11 ft. 10 in.	2 ft. 8 in.	6 ft. 4 in.
8	13 ft. 8 in.	2 ft. 8 in.	7 ft. 2 in.
9	15 ft. 6 in.	2 ft. 8 in.	8 ft. 0 in.

THE MOVABLE TYPE

For the occasional need or special condition when auxiliary seating, that can be quickly and easily moved from one location to another, is required. . . . Seats operate on the approved telescopic principle. . . . Ideal for use on the stage; in combination lecture and classrooms; to encompass the boxing or wrestling ring—and wherever else spectators must be accommodated with safe, practical, satisfactory seating. Easily moved to and from the storage room.

In the interest of safety and convenience in handling, each section is limited to 7 ft. in width. For the same reason, the maximum number of rows of seats that may be had in the movable type is 6. This is also the standard and most economical size, although smaller units are available as listed in table above.

Medart Engineering Service
A competent staff of Medart engineers is available to help you plan and lay out the most efficient and economical installation of equipment to meet your own special requirements. No obligation.

MEDART CATALOGS
Telescopic Gym Seats....Catalog GS-3
Basketball Backstops.....Catalog BB-2
Physical Fitness (Gymnasium) Equipment .....Catalog G-4
Steel Lockers .....Catalog L-7
Steel Lockerobes .....Catalog LRM-4

Also see pages 524, 525 this issue

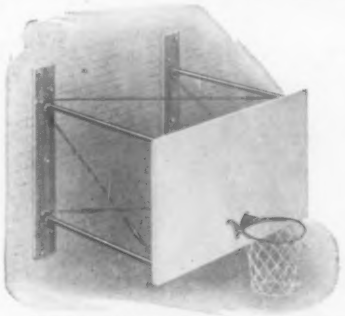
MEDART BASKETBALL BACKSTOPS

BALCONY TYPE BACKSTOPS

An economical method of installation but having obvious disadvantages. It is advisable to limit this type to practice courts. May be permanent (No. 478) or detachable (No. 479).

Backboard attached flush to face of balcony below floor level. Undesirable from spectators' viewpoint and because of restricted shots from corners of floor (No. 480).

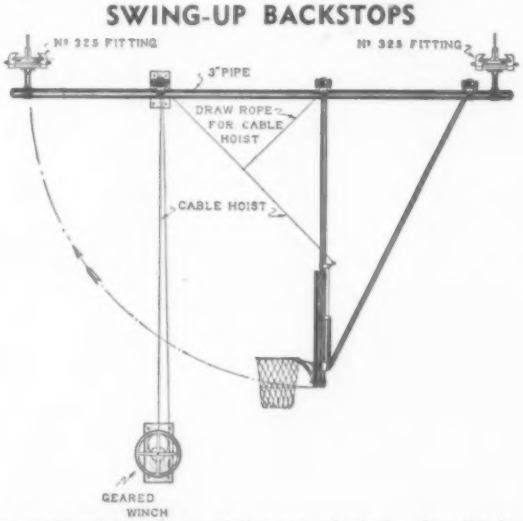
WALL BRACED BACKSTOPS



This backstop can be furnished with various length extension braces—2 ft. (No. 55), 3 ft. (No. 458), 4 ft. (No. 459), 5 ft. (No. 461). 6-, 7-, or 8-ft. braces can also be supplied.

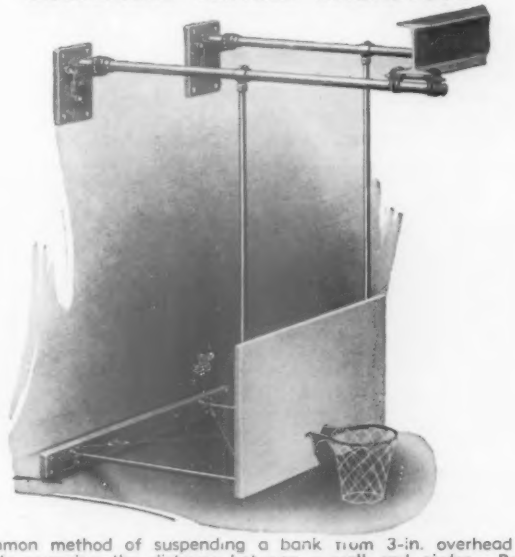
Structural condition and building equipment often necessitate special support. Illustration shows a bank with 2-ft. braces. (No. 439). Can be modified to suit.

SWING-UP BACKSTOPS



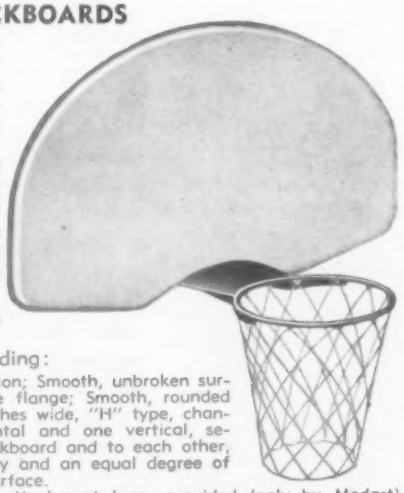
A steel cable attached to a friction geared winch raises the backstop forward, up to the ceiling. Diagonal braces are double knuckle jointed and elongate as backstop is being raised forward. When in lowered position, braces are automatically locked (No. 261).

SUSPENDED BRACED BACKSTOPS



A common method of suspending a bank from 3-in. overhead pipe supports spanning the distance between a wall and girder. Recommended where walls are weak, where interference prohibits wall stringers, and where heavy banks are extended excessively (No. 420).

BACKBOARDS



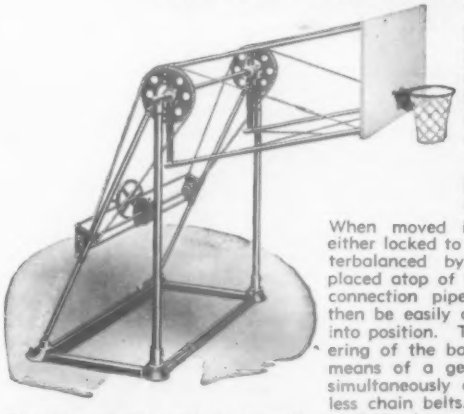
We no longer manufacture rectangular-shape backboards as shown in above illustrations, but furnish only the new fan-shaped backboard made official by the National Basketball Committee of the United States and Canada. The **Medart Steel Fan-Shaped Basketball Backboard** has many superior and exclusive features, including:

One-piece steel construction; Smooth, unbroken surface; Deep 1½-inch side flange; Smooth, rounded edges; Steel braces 3 inches wide, "H" type, channel shaped—two horizontal and one vertical, securely welded to the backboard and to each other, providing absolute rigidity and an equal degree of bracing to the entire surface.

Four sets of 2 floating attachment lugs—provided (only by Medart) so that new backboards may easily be attached to old braces.

This backboard is fabricated to the same degree of perfection as the old Medart backboard. Size: 54 x 35 inches.

PORTABLE BACKSTOPS



Where girder heights in field houses are excessive, this floor-type backstop is ideal. It can be moved from place to place without dismantling.

When moved into position and either locked to the floor or counterbalanced by concrete blocks placed atop of the two rear base connection pipes, the bank can then be easily and quickly raised into position. The raising or lowering of the bank is effected by means of a geared winch which simultaneously operates two endless chain belts.

The face of the bank is brought out 7 ft. from the foremost pipe uprights and over 10 ft. from the cross pipes supporting the winch, thus giving maximum clearance under the basket. This backstop is practical, rigid, ruggedly built and easily handled (No. 455).

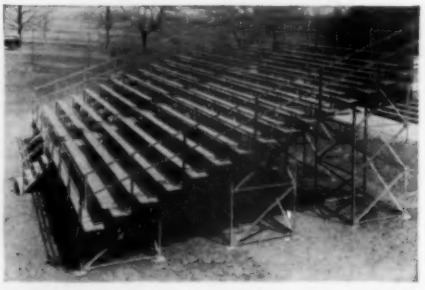
WAYNE IRON WORKS

Wayne Penna.

Folding & Rolling Gymstands, Steel Portable Grandstand, Permanent Stadiums, Steel Deck Stands, Fencing of all types . . . for boundary, athletic fields, tennis courts, etc.

WAYNE GRANDSTANDS FOR EVERY NEED . . .

Steel Deck Permanent—This is one of several types of permanent grandstands built by Wayne. Each installation designed to fit conditions at the site. An advantage of this particular waterproof, weatherproof, fireproof, frostproof steel deck type grandstand is that locker and shower rooms may be located under stand.



Type "G" Stadium Portable—Spacing of seats and width of foot rests same as in general stadium construction, allowing ample room for passage of late-comers. Can be built up to 50 rows, without foundations or use of tools. Number of rows as well as length may subsequently be increased.

Rolling Gymstand—The ideal indoor stand. One man, in five minutes, can provide a thousand grandstand seats, and in equal time make them virtually disappear. Any desired number of rows. **Rolling Movable Gymstand**—Same as rolling gymstand except when closed can be moved from place to place, on two-caster trucks.

Folding Gymstand—Illustration shows Wayne Folding Gymstand and how it operates. Folded, it fits snugly against the wall; unfolded, it provides mass seating, with maximum comfort, safety and visibility. Counterbalanced with strong, durable springs, it may be easily opened or closed by one person.

WAYNE SERVICE

If you have a grandstand seating problem Wayne can help you solve it. Through 25 years of operation, Wayne has accumulated a vast background of information in the specialized field of outdoor and indoor seating equipment. This experience ranges from the design and erection of a twenty-two thousand seat stadium down to the smallest portable grandstand.

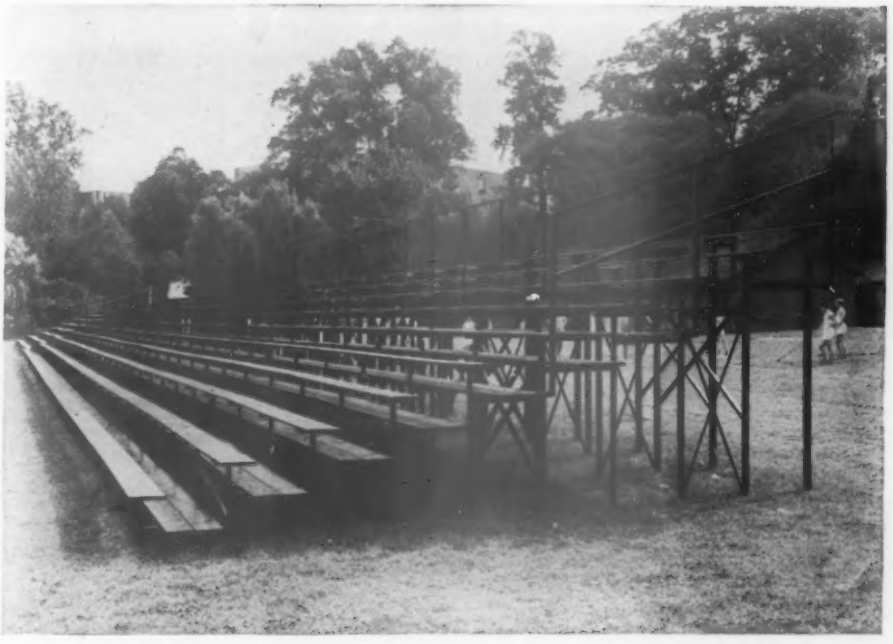
A Wayne representative will come directly to your office to study your requirements. He will determine the number of seats to be erected on the available space and make recommendations consistent with requirements and cost limitations. He is always ready to give you advice without obligation, and as the Wayne line is complete, his recommendations are made without bias.

The Wayne Iron Works was the originator of the "Gymstand" and was the first to design and construct a steel portable grandstand. After years of constant improvement, every Wayne Grandstand assures complete safety and comfort to the spectator. Our specialization is your assurance that calling in Wayne, will be the wisest move you can make. In the meantime, if suggested layouts from our engineering department are desired, give complete details as to your requirements. An order placed now will facilitate delivery when manpower and materials are released for civilian production. Write for your copy of the book—"Speaking of Postwar Plans."

WAYNE SALES REPRESENTATIVES

Albuquerque, N. M., 302 East Central, P. O. Box 814
Alexandria 2, La., P. O. Box 372
Athens, Ga., 321 East Clayton St.
Baltimore, Md., 806 Venable
Birmingham 3, Ala., 724 Chamber of Commerce Bldg.
Cambridge, Mass., Kendall Sq.
Chicago 41, Ill., 4818 Oakdale Ave.
Columbus, Ohio, 2481 N. Fourth Ave.
Denver, Colo., 812 Twelfth St.
Deland, Fla., P. O. Box 786
Detroit, Mich., 604 Donovan Bldg.
Evansville 8, Ind., 810 Main St.
Houston, Texas, 852 M & M Bldg.
Huntington 9, W. Vir., 13th St. and 2nd Ave.
Indianapolis, Ind., 4257 E. 34th St.
Iowa City, Iowa, 722 Rundell
Lincoln, Nebraska, 1126 Q St.
Little Rock, Ark., 215 W. Second St.
Los Angeles, Calif., 1722 Griffin Ave.
Louisville, Ky., 928 Howland Ave.
Kansas City, Mo., 1322 W. 13th St.
Mamaroneck, N. Y., 71 Tompkins Ave.
Maplewood, N. J., 26 N. Crescent
Memphis, Tenn., P. O. Box 991
Monroe, La., 125 St. John St.
Montgomery, Ala., 745 N. McDonough St.
Nashville, Tenn., 2210 Elliston Place
New York City, 155 E. 42nd St.
Oklahoma City 1, Okla., 317 N. Robinson, P. O. Box 716
Phoenix, Ariz., Box 2379
Pittsburgh, Pa., 601 Empire Bldg.
Rochester, N. Y., 33 Aster Drive
Raleigh, N. C., 14 Glenwood Ave.
St. Louis, Mo., 300-301 Board of Education Bldg.
St. Petersburg, Fla., Central St..
Salt Lake City, Utah, 70-72 W. 2nd South, P. O. Box 263
Sioux Falls, S. D.
San Francisco, Cal., 3030 Steiner St.
Valley Stream, Long Island, N. Y., 220 E. Merrick Rd.
West Allis 14, Wisc., 2365 S. 60th St.
West Lawn, Pa., 2317 Spring St.
Wilmington, Del., 736 Nottingham Rd.

"Wayne Stands for Safety"



TYPE "H" STANDARD PORTABLE

Neat appearance, adaptability and low cost have made this Wayne steel portable grandstand very popular, especially where limited budgets are involved. Made in 16 foot units and available up to 15 rows high.

This is one of several standard types of grandstands designed for maximum economy. Special requirements can usually be met by simple modification of standard designs. Write for illustrated descriptive literature, or outline your needs for our recommendations.

SPECIFICATIONS FOR WAYNE TYPE "H" GRANDSTAND

1. General Description— (a) Furnish, f.o.b. , linear feet of row portable steel bleachers, to be Type "H" as manufactured by Wayne Iron Works, Wayne, Pa., or equal, as approved by

2. Design— (a) Bleachers shall be designed to support, in addition to their own weight, a live load of 120 pounds per linear foot of seatboards, plus 120 pounds per linear foot of footboards, and to withstand a side sway load of 24 pounds per linear foot of seatboard and a front-to-back sway load of 10 pounds per linear foot of seatboard. Under these loads stresses in steel shall not exceed those specified by the American Institute of Steel Construction, and stresses in wood shall not exceed those specified by the U. S. Forest Products Laboratory. The bleachers shall be so constructed that they will conform to inequalities in the ground without increasing stresses beyond the limits specified, and without jeopardizing the stability of the structure or the safety of its occupants.

(b) For Pennsylvania only: The successful bidder shall submit satisfactory evidence of the formal approval of the Pennsylvania Department of Labor and Industry of the particular type of bleacher he proposes to furnish.

3. Seat and Footboards— (a) Seat and footboards shall consist of clear lumber 16 feet long, surfaced 4 sides to 1⅛" x 9½" and shall be bolted during erection to the supporting frames.

4. Painting— (a) All parts of the bleachers shall be properly cleaned and shall have one coat of best quality enamel or lead and oil paint applied at the shop.

5. Railings— (a) Railing shall be of steel, 3 feet high above the seats, have two rails, and shall be bolted to the supporting frames during erection. They shall be capable of supporting a vertical load of 80 pounds per linear foot and a horizontal thrust of 25 pounds per linear foot.

DIMENSIONS AND SEATING CAPACITY—The Wayne type "H" portable steel stand is made in 16 foot standard lengths, from 2 to 15 rows high. The depth of a 2 row stand is 2'-7½" and the dimensions range up to 26'-11" in the case of the 15 row stand. Height of top seat of the 2 row stand is 1'-11¾" and that of the 15 row unit is 10'-7¾". Railings are provided on stands of 6 rows and up as required. Seating capacity based on a width of 16" per seat, can be determined by multiplying the number of units by the figures indicated below.

		2 Rows	3 Rows	4 Rows	5 Rows	6 Rows	7 Rows	8 Rows	9 Rows	10 Rows	11 Rows	12 Rows	13 Rows	14 Rows	15 Rows
L'gth	No. Units	← SEATING CAPACITY →													
16'	1	24	36	48	60	72	84	96	108	120	132	144	156	168	180

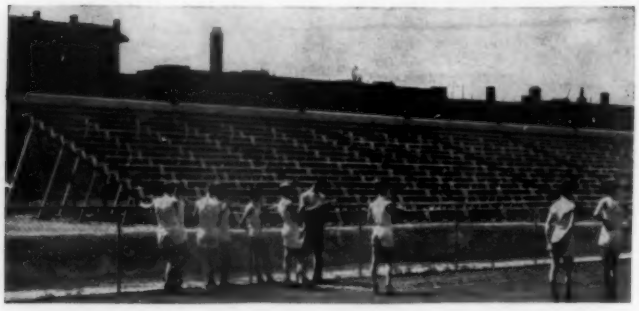
Specifications covering Wayne "Gymstands", both rolling and folding, appear in Sweets' File for Architects.

"Wayne Stands for Safety"

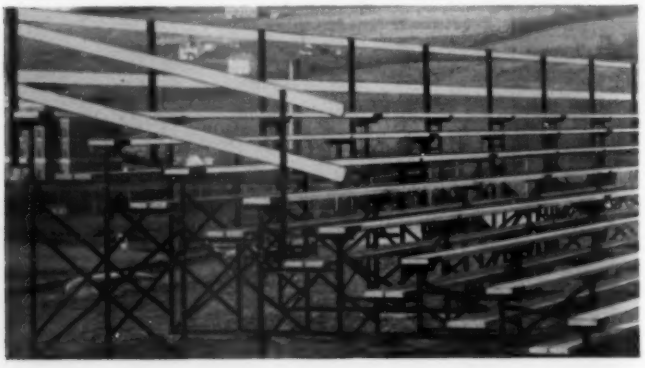
UNIVERSAL BLEACHER COMPANY

608 South Neil Street, Champaign, Illinois

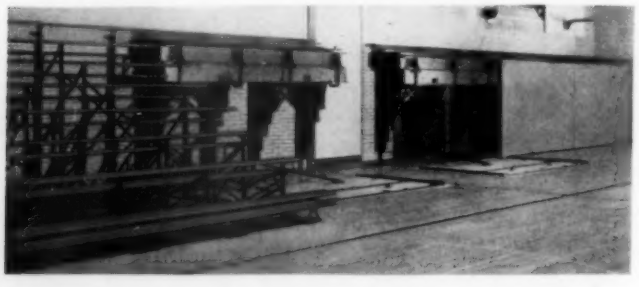
Manufacturers of "Roll-A-Way" and "Fold-A-Way" Gymnasium Stands & Portable Wood and Portable Steel Bleachers



UNIVERSAL PORTABLE WOOD BLEACHERS . . .
Designed for ease and speed of erection. Sleepers, stringers, seat and foot boards securely bolted to prevent splitting.



UNIVERSAL PORTABLE STEEL BLEACHERS . . .
Strong and comfortable as permanent stands. Easily and quickly erected without special tools. For indoor and outdoor use.



UNIVERSAL "Fold-A-Way" GYMNASIUM STANDS . . .
Eliminate all direct floor attachments. Counterbalanced for ease of operation. Cabinets open independently of stand sections.

UNIVERSAL "Roll-A-Way" GYMNASIUM STANDS . . .
Safe, comfortable seating for capacity crowds. Use valuable floor space when the stands are not in use.

UNIVERSAL — the world's largest manufacturers of bleachers — have been experts in the field for over 30 years. The entire UNIVERSAL factory is devoted exclusively to the manufacture of bleacher seating. Our designers and engineers are specialists in the field . . . our shops are equipped with the most modern machines . . . our workmen are chosen for their ability and take pride in their work. This results in bleachers of superior design and operation; of safe, sturdy construction; of lasting satisfaction to the customer.

Leading schools, colleges and universities all over the country are using UNIVERSAL seating in their gymnasiums and on their athletic fields. We invite your personal inspection of the UNIVERSAL installation nearest you. To aid you in this, we will supply names and addresses at your request. Write for illustrated descriptive literature of UNIVERSAL bleacher and gymnasium stands.

Today . . . PLAN FOR TOMORROW'S SEATING

Take the first step — Now, toward solving your seating problem the UNIVERSAL way. Send the measurements of your present or proposed athletic field or gymnasium. UNIVERSAL will be glad to help you with suggestions and plans — to quote estimates and budget figures without obligation.

Many of the leading Colleges and Universities throughout the United States, as well as High Schools in every state in the Union, are now using UNIVERSAL equipment. Space will not permit a full listing of all UNIVERSAL users, but a partial list of some of our colleges and university installations follows:

Penn State
Drake University
Duke University
University of Iowa
Purdue University
Colgate University
Stanford University
University of Chicago
University of Wyoming
Ohio State University
University of Illinois
University of Minnesota
University of Notre Dame
University of North Carolina
Massachusetts Institute of Technology

UNIVERSAL "Fold-A-Way" TABLE OF SIZES

Rows High	Depth Opened	Depth Closed	Space Gained	Height In Use	Height Closed
3	4′ 8″	1′ 8″	3′ 0″	3′ 0″	3′ 0″
4	6′ 6″	1′ 11½″	4′ 5½″	3′ 11½″	3′ 11½″
5	8′ 4″	2′ 3″	6′ 1″	4′ 11″	4′ 11″
6	10′ 2″	2′ 6½″	7′ 7½″	5′ 10½″	5′ 10½″
7	12′ 0″	2′ 10″	9′ 2″	6′ 10″	6′ 10″
8	13′ 10″	3′ 1″	10′ 9″	7′ 9½″	7′ 9½″
9	15′ 8″	3′ 5″	12′ 3″	8′ 9″	8′ 9″
10	17′ 6″	3′ 8″	13′ 10″	9′ 8½″	9′ 8½″
11	19′ 4″	4′ 2″	15′ 2″	10′ 8″	10′ 8″
12	21′ 2″	4′ 8″	16′ 6″	11′ 7½″	11′ 7½″

UNIVERSAL "Roll-A-Way" TABLE OF SIZES

Rows High	Depth Opened	Depth Closed	Space Gained	Height In Use	Height Closed
3	4′ 8″	1′ 2¾″	3′ 5¼″	2′ 10½″	2′ 10½″
4	6′ 6″	1′ 7″	4′ 11″	3′ 7″	3′ 7″
5	8′ 4″	1′ 11″	6′ 5″	4′ 3½″	4′ 3½″
6	10′ 2″	2′ 3¼″	7′ 10¾″	5′ 0″	5′ 0″
7	12′ 0″	2′ 7¼″	9′ 4¾″	5′ 8½″	5′ 8½″
8	13′ 10″	2′ 11½″	10′ 10½″	6′ 5″	6′ 5″
9	15′ 8″	3′ 3½″	12′ 4½″	7′ 1½″	7′ 1½″
10	17′ 6″	3′ 7¾″	13′ 10¼″	7′ 10″	7′ 10″
11	19′ 4″	3′ 11¾″	15′ 4¼″	8′ 6½″	8′ 6½″
12	21′ 2″	4′ 4″	16′ 10″	9′ 3″	9′ 3″

EQUIPMENT AND SUPPLIES

A school plant, like any other plant, contributes to the success of the undertaking which it houses to the extent to which it provides proper facilities to carry out the program. A schoolhouse without proper equipment and supplies would be as ineffective as the Willow Run plant if it had no equipment to produce aircraft.

Educators and architects have not always given sufficient emphasis to the supplies and equipment necessary to the functioning of the program housed in perfectly good plants. Here lies another field for continued study and research. This section of the AMERICAN SCHOOL AND UNIVERSITY is presented to aid school and college officials with the problems involved in this area of study.

SELECTING SUPPLIES AND EQUIPMENT

By JOHN W. LEWIS, Assistant Superintendent
and H. SPILMAN BURNS, Senior Supervisor of Educational Supplies and Equipment
Department of Education, Baltimore, Md.

THE first important task of a supply department is the clarification of its aims. Its guiding principle must be service to the educational program by providing the best possible aids to learning. All else is incidental. The application of sound business principles to the various procedures should not be inconsistent with the achievement of educational objectives. When the fundamental aim is recognized all other procedures and methods fall into a logical pattern of relative importance.

If the supply department is to serve effectively, a knowledge of the educational program and method is highly important. The liaison with the educational personnel should be continuously maintained. Suggestions will come from the educational division on the basis of use and need, and from the purchasing division on the basis of its knowledge of new products or improvements which arises out of its expanding knowledge of equipment and materials. In an efficient supply department all discussion of the ultimate responsibility of the educational divisions and the purchasing division for the selection of the type and quality of items becomes academic. Selecting the proper item will be a coöperative effort, and when conducted on the basis of objective data and not subjective opinion there will be no unresolved conflicts.

Steps in Selection of Supplies

The first step in selection is the determination of the purpose to be served and the type and characteristics of the item which will best serve that purpose. While the procedure varies with the item, the application of this procedure to certain duplicating supplies will serve to illustrate some of the activities.

Page facing—It is highly important for the supply department to have "a knowledge of the educational program and method"

The selection of the method and hence the equipment to be used will depend upon the number of copies usually required. On this basis the selection would be:

1 to 10 copies	typing with carbon copies (or for two or three contact prints, a photocopying machine)
Up to 100 copies	gelatine type
Up to 300 copies	fluid type
Over 300 copies	stencil type
Exceptionally long runs	possibly off-set

Other questions also enter into the decision particularly regarding the supplies to be used. Mimeograph paper may be taken as an example. Such questions as the following should be answered: To what use will the copies be put? Must the copy take pen and ink? Will the material be duplicated on one side or two? Is the material to be mailed first-class, so that light weight becomes an important factor? Will the machine be operated by a skilled operator or by persons of limited skill, so that such items as skippage become more important? From the answers to these questions come decisions regarding weight, finish, opacity, quality of pulp, bulkiness of sheet, stiffness, etc. These decisions in turn become the basis of a specification.

In some cases conflicting characteristics must be compromised. If pupils, for example, are to color some copies run off by a gelatine duplicator, the paper should not have as high a finish as would be required for the best results on a gelatine machine.

It is important that the quality standard be set at the lowest level which will meet the need effectively. Higher standards than required, or the inclusion of unessential characteristics, will result in waste through higher costs. Lower standards than required for efficient use will waste instructional expense through lowered efficiency. It is not enough to ask: Will this item meet the need? We ask further: Would a paper of lighter weight meet the need practically as well? Would an increase in weight result in greater usefulness and justify increasing costs? Would the paper be improved by a change in finish? Do we need a full chemical pulp or would its use permit ground wood stock? Similar questions appropriate to other items result in an analysis of the *specific qualities* of an item which affect its cost and utility. In other words, if an item is not satisfactory, *in what particular respect* is it unsatisfactory? In what characteristic does the basis of selection need to be changed? The wise purchasing agent will ask himself questions regarding an unlimited number of char-

Essential to a well-rounded educational program is a diversified supply list

Multiplicity of items can be reduced by a process of standardization and simplification

acteristics, such as: Is the absence of poisonous ingredients in this item important? What preservative against deterioration do we need for this paste? What working qualities must this crayon possess in the way of even spread and absence of "build-up"? This constant detailed analysis for setting quality standards is the basis of intelligent selection.

The development of standards of type, size, and quality for each item, without regard to standards set for other items would lead to needless multiplicity of unessential differences. The next step is logical grouping, to reduce as much as possible the number of kinds, sizes, and qualities. The same paper stock, for example, will serve for both the ruled and unruled items, for theme paper, and for notebooks. Sizes will be examined before standardization to make certain they can be cut without waste from standard sizes.

This process of standardization and simplification as applied to the various papers for art work will result in 90 per cent of the need being filled by a few basic qualities:

1. Paper for kindergarten cold water paints. This type of work usually requires a large sheet of paper. Newsprints, 32 lb. substance, or lighter weight krafts (40-50 lbs.) in the lighter shades will be satisfactory. (For some art work in the kindergarten or lower grades some detail paper in rolls will fill a need where pictures in the nature of a frieze are planned.)

2. Paper for pencil and crayon work. This quality will stand a little erasing with a soft eraser. It may be of ground wood stock. The finish should give a slight "tooth" which may be the same on both sides. The minimum weight would be substance 50 lb.

3. Paper for pencil, crayon, plus water color. This paper is slightly heavier (substance 70 lb.) and of a somewhat better quality (Mullen test approximately 35). It will be either a good grade of ground wood or a mixture of ground wood and chemical pulp. The finish should give some "tooth" on one side with less "tooth" on the reverse side. It will stand more erasing than the lower grade listed above.

4. Paper for pencil, crayon, water color, and mechanical drawing. This paper is heavier (substance 90 lb.). It should stand severe erasing, e.g., the erasing of india ink. There is some sacrifice in the consolidation on this quality, since mechanical drawing will require a finish with less "tooth" than may be best for art work. One side should therefore be finished with more "tooth" than the other. A Mullen test of 55 to 60 should require a 100 per cent chemical pulp.

What therefore might appear as an endless series of types and qualities falls into a much simpler pattern.

The various required sizes in each of the qualities will supply the principal needs of the school. Other special types of art paper will be required in the interest of a well-rounded program but the quantities of these special papers are relatively limited. The following are examples of additional special needs to be provided: a small quantity of higher grade hot pressed or cold pressed finishes; charcoal papers, colored construction or poster paper; newsprint for preliminary sketching, block printing papers, papers for novelty work.

In this work of simplification and standardization, a thorough knowledge of simplified practice programs of the U. S. Bureau of Standards is essential. The procedure outlined above should be applied to other sections of the supply list.

Writing Equipment Specifications

The same principles apply to the selection of equipment as to the selection of supply items. Factors such as efficient layout, safety, simplicity of construction and operation, posture, and maintenance become increasingly important.

As an example of the procedure followed in the selection of equipment, the installation of gymnasium lockers may be taken. The first question, again, is, What is the educational program to be served? With the program defined as calling for one period of physical education daily in a seven-period day, the requirements are as follows:

1 locker for each pupil enrolled (storage of gym clothing)
1 locker for each pupil using the gymnasium at one time (approximately 1/7 of total enrolment (storage of street clothes)
Convenient arrangement to avoid congestion while dressing
Adequate provision for ventilation of lockers
Adequate locking arrangements

To meet the above requirements the number of lockers is computed from the schedule of requirements. Convenient arrangement is provided by scattering the dressing lockers throughout the locker room, two dressing lockers (double tier 12 x 15 x 36) for each 14 compartment lockers. To provide adequate ventilation a box locker (12 x 12 x 12) is discarded in favor of a locker (7½″ wide, 24″ high, 15″ deep) in which the clothes may hang instead of being rolled in a small bundle. The lockers are separated 6″ back to back and the intervening space enclosed with panels. This 6″ air space is ventilated mechanically, louvers being provided in each locker door and holes punched in the back of each locker to permit free passage of air through the locker. Planning in advance of construction permits built-in cove bases and, where conditions are favorable, vents through the floor in order that the ventilating ducts may be carried on the ceiling of the floor below—eliminating much unsightly duct work in the locker room. Adequate locking arrangements are provided by combination padlocks—one for each compartment locker. This padlock is transferred to the dressing locker while the student is using the gym and back to the compartment locker when he leaves, releasing the dressing locker for the next class.

Having thus met the educational requirements, we are ready to write the specification for construction details of the lockers, including details of framing, gauge of metal, type of hinge, reinforcement of door, spacing of bolts, latching device, padlock attachments, louvers, finish, etc.

Does Company Have Fair Service Policy?

The assurance of permanent efficient service is highly important in the selection of equipment. Many schools are cluttered with equipment for which repair parts and service are no longer available. The company's attitude on service is a most important consideration. Some companies rely more heavily on the profits on supplies and service than on the profits from the sale of equipment. Where the modern Jesse James is revealed in excessive service or supply charges, additions of such equipment should be limited as much as possible and equipment secured from a company with a much fairer service policy.

Has Item Proved Its Merit?

There is always the danger of being tempted by a new "gadget." A clever salesman may impose on schools items whose utility fades rapidly when the enthusiasm of the salesman is withdrawn. Shakespeare was giving good purchasing agents advice when he said, "Be not the first by whom the new is tried, nor yet the last to lay the old aside." It is always wise to wait until an item has proved its merit and the "bugs" which are inherent in many new products have been eliminated.

Avoid Non-Competitive Items Where Possible

In general, it is advisable to avoid selecting items which require supplies obtainable only from one manufacturer. In selecting a stapling machine, for example, select one not requiring a special staple. A careful examination of many "trade name" items of supply for use on a given machine will reveal that equivalents may be bought on the basis of an open specification. Alcohol for "spirit" type duplicators and various kinds of duplicating papers are examples.

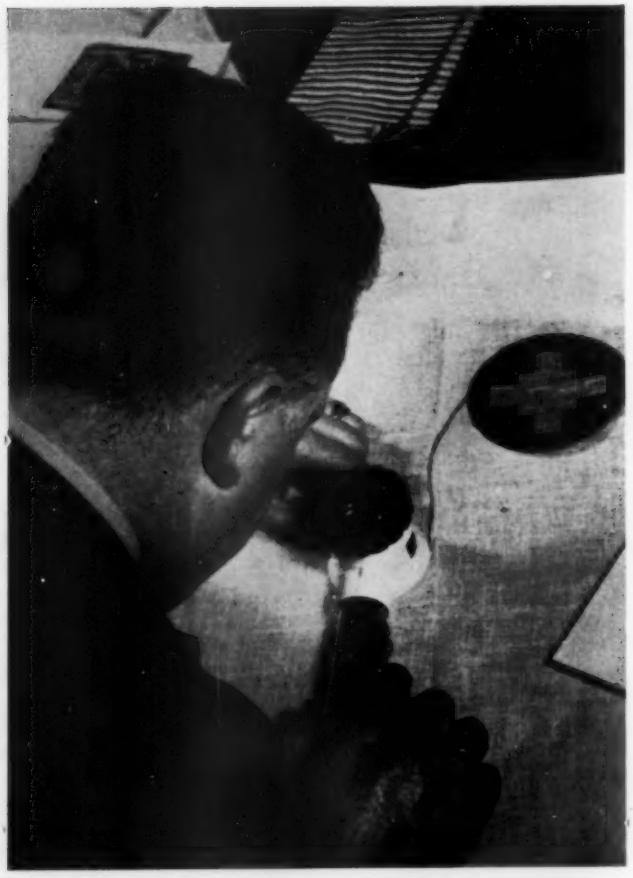
Is Packaging Economical?

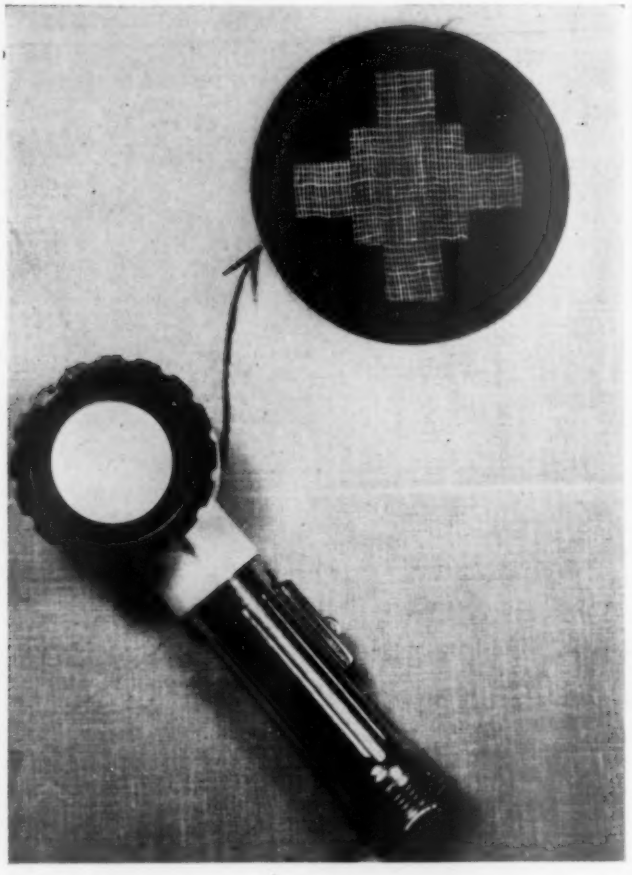
A careful study of the most economical form and size of packaging should be made. Purchase of paste in small tubes for classroom use would not be economical although justified for occasional desk use. When the quantity used justifies it, purchases in gallons to be issued to students in small individual jars will result in lower prices.

Wise purchasing will frequently indicate the desirability of avoiding purchasing of "sets" of items. The purchase of gross boxes of assorted colored chalks, for example, will result in the use of the more popular colors, leaving many colors unused. Smaller packages of solid colors will enable the school to fill its needs without waste. The same reasoning will apply to assortments of colored papers, colored pencils and similar items.

Build Specifications Around Tests or Analyses

Having analyzed in detail the essential characteristics of an item, the next step is to list these characteristics in the form of a specification. Other details, such as size, packaging, etc., complete the specification. The specification should be broad enough to admit every item which would meet the need satisfac-





Taking of a thread count on a piece of fabric. The dark circle disk indicates what is seen through the illuminated magnifying glass. "Standards should be continually questioned by testing activity and specifications revised as required"

torily and yet narrow enough to rule out items which are not acceptable.

When writing specifications for materials, the testing program should be kept in mind. It will be of little value to include requirements in the specifications which the user cannot have tested. Performance specifications with simple tests to check them are recommended whenever practical and wherever chemical analysis is not required. The following is an example of a specification built around simple testing methods:

> *CRAYONS:* pressed, 8 in box: hexagonal in shape, approximate size 5/16" x 3½" long. These crayons shall be strong, evenly pressed, free from air spaces and warp, and shall have a high breaking strength. All crayons shall be sharpened with a blunt point. The texture quality of these crayons shall be uniform and shall give an even distribution of color without excess "packing" and without excess "flaking" when used. All colors shall run uniform, shall be good intense hues, and each color shall blend satisfactorily with each of the different colors. They shall be free of grit and other foreign materials which will affect the quality of work which they produce. The working qualities of each color crayon shall be uniform and shall not have excess "drag," nor shall they "slide" too freely when being used. Each crayon shall be substantially wrapped in a strong paper wrapper, color of paper to be the same color as the crayon. These wrappers shall present a neat, even appearance. Each box shall contain one each of the following colors: red, yellow, green, blue, purple, orange, brown, black. Packing in accordance with simplified practice #R-192-42. Bidder shall indicate brand bid on.

In the above specifications it is not essential to indicate the breaking strength in terms of pounds; the contents in percentage of wax, clay, pigment; since what is wanted are crayons that will perform in such a way as to meet classroom requirements as stated in the specifications. A satisfactory testing method will be to remove labels or identification from each crayon (blindfold method) and actually use the sample crayons for the construction of a color chart, so arranged, that the color blocks produced by the crayons of each manufacturer can be compared with those produced by the crayons of competing firms. Working qualities of each crayon should be noted opposite each color block.

In other cases where a comparison of quality cannot be determined by simple testing methods, more exact specifications requiring chemical analysis is in order. An example of such a specification would be one indicated below:

> CLEANING POWDER: shall be composed of finely powdered volcanic ash and powdered soap in the following proportions:
>
> Volcanic Ash—50 to 55 per cent
> Anhydrous Soap—15 to 20 per cent
> Sodium Carbonate—20 to 25 per cent
> Moisture not to exceed 15 per cent
>
> Cleaning powder shall be delivered in strong 5 lb. cloth bags or pasteboard cartons, marked "Detergent." The bidders are requested to state type of container they propose to use. It is agreed and understood that the successful bidder shall be required to submit a sample

bag or carton marked "Detergent," for approval, before making delivery.

Testing of materials is essential to proper selection of educational supplies and equipment. An adequate program of testing will permit the detailed analysis of the various qualities of a given item. Without such detailed analysis, specific recommendations for change or improved selection are almost impossible. This testing may be in the nature of a simple testing program where many of the performance tests can be performed by the average buyer possessing adequate equipment and some reasonable skill. In many cases chemical analysis will be required, and if the buyer does not have necessary facilities the services of an outside laboratory should be secured.

This testing is not a one-time activity, used only when a new item is added to the list. To be effective, the testing program should be continuous because manufacturers' practices, as well as classroom requirements, change from time to time. Standards should be continually questioned by testing activity and specifications revised as required.

Testing of samples submitted on bids will serve many purposes in addition to that of determining the lowest bidder meeting specifications. Some school systems require few samples with bids, and do little testing before award, because they feel that this delays unduly the awarding of contracts. This places a greater responsibility on the vendor and places greater pressure on the buyer to accept material not meeting specifications. Failure to meet the specifications is not evident at the time of the bid but only on delivery, at a time when rejection would work undue hardship on the bidder and cause the schools serious delay in the receipt of their supplies. Testing of samples at the time of bid is a fruitful source of information for the possible revision of standards. An item which technically fails to meet specifications may be entirely satisfactory for the purpose. If of sufficient benefit, bids may be rejected for immediate revision of specifications. Otherwise the item may be passed over on the bid and future standards of selection and specifications revised accordingly. Submission of alternates, even though they do not meet specifications, thus paves the way for continued improvement in selection.

Testing of supplies as delivered to be certain they meet the requirements which have been set up constitutes an element of selection on delivery and is an important step in the procurement of properly selected materials.

Whims vs. Objective Facts

Some departments of a school system may have vague but intense likes or dislikes. One company's crayons may have given satisfaction over a period of years and hence no other crayon is considered by the department as being its equal. If such judgment is sound it must be capable of demonstration by "blindfold" tests in which the trade names have been removed. If the qualities are not up to standard they should become evident when test charts are made up as previously described. When any product is highly satisfactory or definitely unsatisfactory the particular qualities making it so should be subject to analysis and determination. If X's waterproof ink is the only one a department wishes to accept, for example, what are the qualities in which it excels? Permanence and waterproof qualities are subject to objective testing of samples drawn with the ink. The flowing qualities can be likewise determined. If no differences can be detected in the product or its use, why pay the penalty for an exclusive non-competitive listing?

Follow-up of Complaints Pays Dividends

It is important that schools be encouraged to report unsatisfactory materials and to give suggestions for improvement of the standards of the supply list. Principals and teachers should be urged to make these complaints as specific as possible, indicating the particular respect in which an item is unsatisfactory.

A follow-up of these complaints and suggestions will frequently reveal necessary changes in the standards, either because the quality of the material is not satisfactory, or because the item is not suitable for the conditions under which it is used. For example, a complaint regarding the quality of typewriter ribbons resulted in an increase in the thread count specified. A quality may be satisfactory under carefully controlled conditions but be entirely unsatisfactory unless an individual be skilled in its use. Frequently, a follow-up of these complaints will eliminate the source of irritation without any change being required in the quality of the supply item furnished. For example, a complaint was received from one school stating that the blotters which were furnished were entirely unsatisfactory. The complaint was based on the fact that the ink was smeared rather than absorbed by the blotter. When this complaint was investigated, it was found that the blotters had excellent absorption qualities but the person making the complaint had failed to clean his inkwell at regular intervals and, as a result, sediment had formed at the bottom of the well. When it was pointed out that the thick sediment of ink in the inkwell could not be absorbed, but that the blotter was perfectly satisfactory with a properly kept inkwell, the complaint was shown to have no basis in fact. On another occasion, a complaint of unsatisfactory paper for use on a fluid-type duplicator was traced to too much fluid and too great pressure on the impression roller, which flooded and forced ink through the paper. The adjustment of operation procedures gave satisfactory results without the necessity of any change in standards. In the cases in which complaints do not justify a revision of standards, the good-will arising from the service of the supply bureau in bringing about proper methods of operation will pay dividends justifying the time expended.

Supply Department Must Continue Efforts

Many supply departments, after having developed a good supply list, rest on their oars and permit the list to remain static year after year. Continued research on new products, together with study of other standards, specifications, and testing methods, and constant contact with the educational program, will be required to maintain a high standard of efficient selection.

AUTHORS' NOTE: Restrictions arising from war conditions affect some of the data of the foregoing report. Since this is judged to be temporary, reference is made to weights of paper, for example, on the basis of usual standards and not those imposed by the War Production Board.

TIPS ON PURCHASING SCHOOL AND COLLEGE EQUIPMENT AND SUPPLIES

By O. G. SAWYER

Purchasing Agent, Duke University, Durham, N. C.

THE trend today is toward centralized buying. In most institutions, the processing of boys and girls is no longer sufficient license to qualify a teacher to act as buyer. Chemistry, physics, zoology, library, and maintenance departments prepare requisitions and send them to the purchasing department. There, trained employees who have made it their business to know purchase procedure, legal status, relationship within and outside the institution, quality, quantity, receiving, storage, salvage, and the handling of invoices determine the processing. The purchasing department knows the what, where, and when of each purchase.

Concentrate Responsibility in One Office

It is reasonable to expect orderly buying, receiving, and issuing, when supplies channel into the institution by way of a single avenue. The many factors that enter into the purchase of a single or of multiple items are assured of proper attention, something which cannot be expected if purchases are made by each department. Sound procedure for purchases rests on these nine basic points:

1. All requests for prices or for repair service, and all purchases, must be made by the purchasing department.
2. Salesmen should be received in other departments only at the request of the purchasing department.
3. If necessary to interview salesmen regarding special details of their products, departments should request such visits through the purchasing department.
4. In interviews with salesmen, no one who is not a member of the purchasing department should commit himself as to preference for any product, the institution's source of supply for any product, or give any information regarding performance or price which might in any way embarrass the purchasing department.
5. All correspondence with suppliers should be conducted through the purchasing department, except in special cases where the technical details involved make it advisable to delegate authority to others. In such cases, the purchasing department should receive copies of all correspondence.
6. The purchasing department should conduct all adjustment negotiations.
7. The purchasing department should have full authority to question the quality and kind of material asked for, so that the best interest of the institution can be served.
8. It should be within the province of the purchasing agent to delegate authority to select material to representatives of the different departments, but the actual purchasing should be done only on the institution's approved purchase order form through the purchasing department.
9. In cases of extreme emergency, and only in such cases, may an exception to the foregoing rules be made.

The Requisites of Good Service

Remembering that to spend money is easy, to spend it well is hard, consider these factors:

Organization.—A well-organized purchasing department is a valuable asset. Whether purchases are handled by one person or several persons, the function and the authority of the department should be defined. Size permitting, the institution should have buyers who are specialists in their work. These should be supported by a stock record and catalog clerk, an order writer, and secretarial assistants. Keep in mind that the purchasing department has only service to give. Make it exceedingly helpful to the various departments.

Procedure.—Do not let the procedure bog down with endless red tape. The aim should be to accomplish the objective in the shortest, easiest manner consistent with accuracy and desired results. A cumbersome system slows operations and causes duplication and general confusion. From ascertainment of the need to statement of character and amount, preparation of requisition, determination of sources of supply, analysis of proposals, follow-up, checking of invoice, receipt and inspection of goods, and completion of record, the procedure should be streamlined and simple, although sufficiently elastic and flexible for either expansion or contraction as the conditions require.

Legal Status.—Teachers in general are not lawyers —neither are buyers. But it is a good idea for the buyer to have sufficient knowledge of law to enable him to understand the relationship between himself and his institution and the legal consequences of the acts he performs in the institution's name. Ability to avoid legal pitfalls is essential. The buyer does not need a law degree to perform a satisfactory job, but he should know the fundamentals so that he can know when legal guidance is necessary.

Departmental Relationship.—The indispensable preliminary to efficient buying and selling, and the giving or getting of service, is contact. The service rendered should reflect credit only. Become known as the hub, the dynamo, and radiate your ability to procure advantageously the wide assortment of school supplies. Study your associates, invite their assistance, lend yours, and what has loomed as a procurement problem becomes relatively easy to solve.

Salesman Relationship. — Pleasant relationships should be cultivated beyond the institution's walls. The salesman who is truly interested in his product

can be of considerable assistance to the purchasing department. Always give him a full, fair, and courteous hearing when it is justified by the nature of his product and your needs. Other rules are: keep competition open and fair; discourage revision of bids after submission and insist on securing the best price first and holding the bidder to it; respect the confidence of the salesman or his company as to quotations or other confidential information; receive salesmen promptly; answer letters promptly; and keep an open mind.

Quality.—No reputable buyer takes the position that price is a matter of first importance. Quality and service are of first importance, and it is the duty of the buyer to secure the quality best adapted to the service. Though the finest grade of material may be required for a particular job, it is true that in another instance material of medium quality is quite satisfactory. In some instances the prime consideration is durability, ease of installation, and maintenance. In other instances the life span is not the prime requisite.

Quantity and Price.—Quantities to be purchased are determined from the known factors of demand, supply, and cost. In normal times this rule works very well. Never lose sight of the fact that stock on hand awaiting consumption represents money. In industry, competition determines whether an advantageous purchase is made. Unfortunately in the educational field the manufacturer's yardstick of value determinations is not applicable. Charity and endowments have long deterred operation of the simple economic rules so common in industry and so exceedingly foreign in educational institutions.

Expediting.—Companies are often lackadaisical in processing orders. Occasionally the order becomes lost in the mails. Yes, occasionally the shipment goes astray in transit. One can be extremely imprudent to place an order and then forget it. The importance of staying with the order until the goods are received cannot be too strongly emphasized.

Receiving. — Shipments should be received by trained personnel. Each department has a primary function to perform; receiving is not part of this job. A person trained to receive shipments knows the precautions he must exercise before signing the freight or express receipt. He is trained to examine minutely the container at a glance. He is cognizant of the rights of seller, buyer, and transportation company. On proper receiving of shipments hinges prompt payment of invoice and, in the event of damage or shortage, proper institution of adjustment.

Inspection.—Goods received are not considered accepted until inspected and found to meet the purchase order specification. While it may be impractical to open all boxes and containers, the purchasing agent should follow through immediately to the department and determine whether the contents are approved. He must not wait a week or ten days for the teacher to call and complain.

Storeroom.—The helter-skelter or basement-to-attic type of storage should not be tolerated. The institution should have a storeroom adequately lighted and furnished to render service in a dignified business manner. The haphazard method whereby the stock of each department is self-contained is out of date. Most institutions are not over burdened with funds, and an efficiently operated central storeroom will make those limited funds do the most good.

Surplus Property.—Disposal of surplus property, scrap, salvage, waste, and drums, and the return for credit of acid containers and cylinders are all functions of the purchasing department. The tendency of each department to become stock sufficient, and the manner in which this checks the release of property that is no longer used is recognized and deplored. Equipment and stock which no longer serve a useful purpose gather dust, represent idle money, and consume space.

The Purchasing Department's Tools

Certain forms and recorded information are necessary.

The Requisition. — The purchasing department should furnish each department with requisition forms. The department indicates in the body of the form the required material, suggests the source if it wishes, and the code. This becomes the purchasing department's

A Separate Sheet Should be Made Out for Each Class of Goods
All Supplies and Materials Must be Ordered by the Central Purchasing Department of Duke University

SUGGESTED SOURCES WELCOMED — DO NOT WRITE IN THIS SPACE

Nº 192792

Dept. No.
Date
Please Itemize and Indicate Estimated Cost in last Column It Will Help in Placing the Order.

Ship to—DUKE UNIVERSITY
Care of
Building — East or West Campus

QUANTITY | UNIT | SEE THAT COMPLETE AND ACCURATE SPECIFICATIONS ARE GIVEN FOR EACH ITEM LISTED. FAILURE TO DO SO WILL CAUSE DELAY. | DO NOT WRITE IN THIS SPACE

EXHIBIT 1

DO NOT WRITE IN THIS SPACE

Shipment in ____ after receipt of order.
F. O. B.
Terms
Quoted — Our Form No. — Your Form No.
Route
This requisition is okey and passed ____ by ____

Date Required
Code No.
Signed
Approved by

FORM 808 25M SETS 11-41

Exhibit 1—Requisition

EXHIBIT 2

ARTICLE AND DESCRIPTION

NO.	VENDOR	ADDRESS	NO.	VENDOR	ADDRESS
1			5		
2			6		
3			7		
4			8		

DATE	VEN. NO.	ORDER NO.	QUANTITY	PRICE	UNIT	DISCOUNT	TERMS	F. O. B.	REMARKS	QUOTATION FILE NO.

PURCHASE RECORD

EXHIBIT 3

THIS IS YOUR COPY—PLEASE KEEP FOR YOUR RECORD

DUKE UNIVERSITY

DURHAM, NORTH CAROLINA

Request to Bid

No. 22815

Your Quotation No.....

Date.....

Please enter hereon or attach hereto your quotation on the following described articles. This tender should be returned to us not later than.....and in the event of its being accepted, a purchase order will be sent. We reserve the right to accept part or all of your bid.

This Is Not An Order

ITEM	QUANTITY	ARTICLES AND DESCRIPTION	NET PRICE

EXHIBIT 4

FORM 950 1500 10-44

ARTICLE

FILE NO.

NAME

Exhibits 2, 3, 4—Price record card; request to bid form (vendor's copy); index card, catalog record

authority to make a purchase if the material cannot be supplied from the central storeroom.

The Price Record Card.—The requisition requires more than superficial examination by the purchasing department. If the specified material has been purchased before, the price record card should contain the date, source, order number, quantity, price, f.o.b. terms, and remarks.

Request to Bid.—The constant changing of market conditions warrants asking sources of supply for current quotations. The request to bid form which is commonly used by many institutions should be sent out in duplicate. The bidder executes both copies, returns one copy, and retains the second copy, which is marked "Bidder's Copy," for his record. As a matter of convenience, the purchasing department should execute the request to bid in triplicate sets, each set numbered in numerical sequence. The original, color yellow, becomes the master copy. The second copy, color blue, and the third copy, color white, are mailed to the vendor. If quotations are required from more than one source, unnumbered duplicate sets of this form in blue and white should be used and given the number shown on the master set.

Catalogs.—Information concerning materials, their properties, sources, and uses is basic for policy and source determination. The efficiency of the purchasing department is often judged by its ability to locate or develop information on new or scarce materials at short notice.

Vendors' catalogs provide a ready source of information. Catalogs that lend themselves to easy filing can be kept in a four-drawer letter-size steel file in alpha-

THE PURCHASING AGENT'S REFERENCE SHELF

THE AMERICAN SCHOOL and UNIVERSITY, by the American School Publishing Corp.,
470 Fourth Avenue, New York, N. Y.
Thomas' Register of American Manufacturers, by Thomas Publishing Co.,
461 Eighth Avenue, New York, New York
Sweet's Catalog File, by Sweet's Catalog Service,
119 West 40th St., New York, New York
Office Appliances, by The Office Appliance Co.,
600 West Jackson Boulevard, Chicago, Illinois
Purchasing, by Conover-Mast Company,
205 East 42nd Street, New York, N. Y.
Soap & Sanitary Chemicals, by MacNair-Dorland Company, Inc.
254 West 31st Street, New York, N. Y.
The Canner, by the Canner Publishing Company,
140 N. Dearborn Street, Chicago, Illinois
The Journal of Commerce, by Journal of Commerce Corporation,
63 Park Row, New York, N. Y.

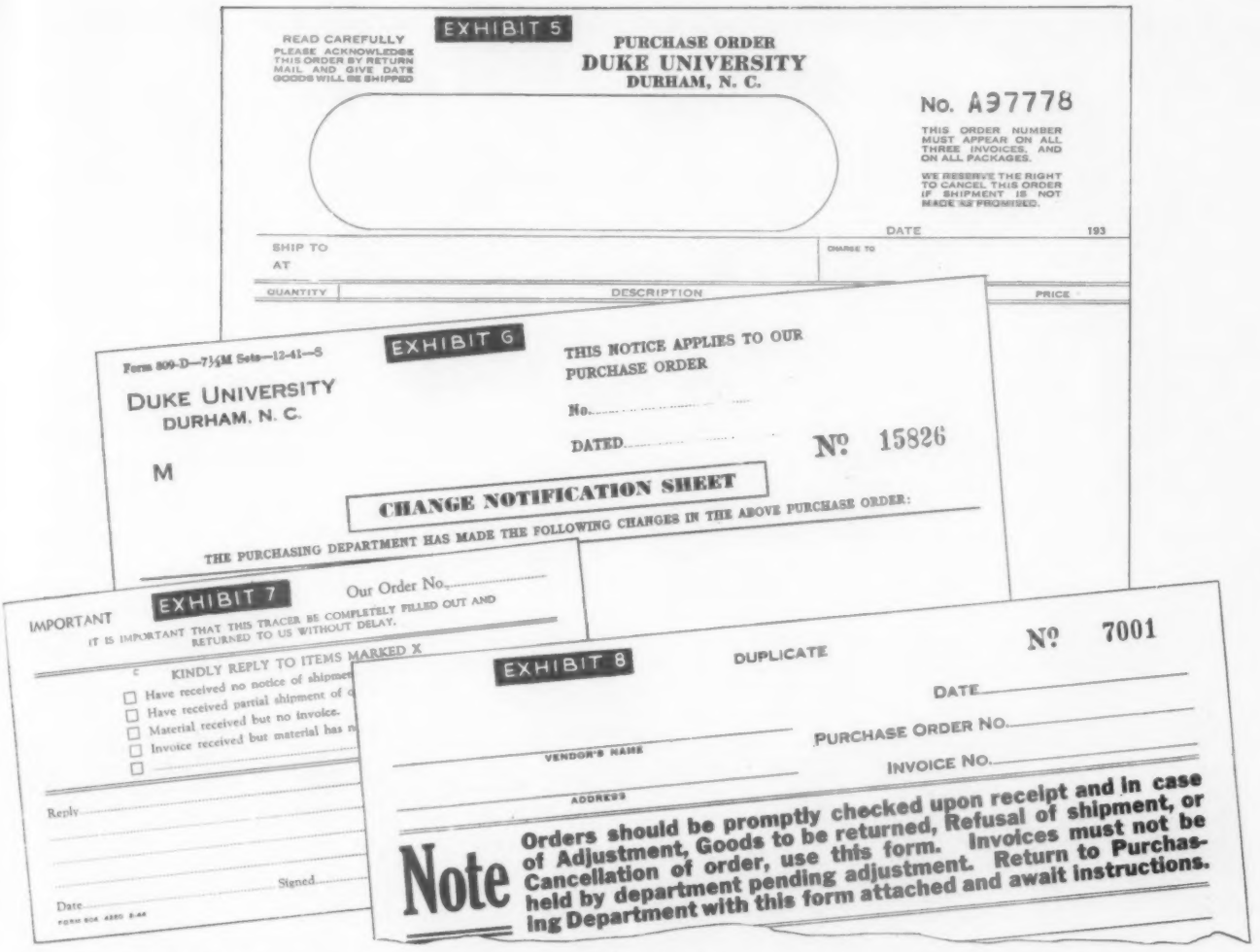


EXHIBIT 5
READ CAREFULLY
PLEASE ACKNOWLEDGE THIS ORDER BY RETURN MAIL AND GIVE DATE GOODS WILL BE SHIPPED
PURCHASE ORDER
DUKE UNIVERSITY
DURHAM, N. C.
No. A37778
THIS ORDER NUMBER MUST APPEAR ON ALL THREE INVOICES, AND ON ALL PACKAGES.
WE RESERVE THE RIGHT TO CANCEL THIS ORDER IF SHIPMENT IS NOT MADE AS PROMISED.
DATE 193
SHIP TO
AT
CHARGE TO
QUANTITY
DESCRIPTION
PRICE
EXHIBIT 6
Form 809-D—7½M Sets—12-41—S
DUKE UNIVERSITY
DURHAM, N. C.
M
THIS NOTICE APPLIES TO OUR PURCHASE ORDER
No.
DATED
Nº 15826
CHANGE NOTIFICATION SHEET
THE PURCHASING DEPARTMENT HAS MADE THE FOLLOWING CHANGES IN THE ABOVE PURCHASE ORDER:
EXHIBIT 7
IMPORTANT
IT IS IMPORTANT THAT THIS TRACER BE COMPLETELY FILLED OUT AND RETURNED TO US WITHOUT DELAY.
Our Order No.
KINDLY REPLY TO ITEMS MARKED X
Have received no notice of shipment
Have received partial shipment of
Material received but no invoice.
Invoice received but material has
Reply
Signed
Date
EXHIBIT 8
DUPLICATE
Nº 7001
DATE
VENDOR'S NAME
PURCHASE ORDER NO.
ADDRESS
INVOICE NO.
Note
Orders should be promptly checked upon receipt and in case of Adjustment, Goods to be returned, Refusal of shipment, or Cancellation of order, use this form. Invoices must not be held by department pending adjustment. Return to Purchasing Department with this form attached and await instructions.

Exhibits 5, 6, 7, 8—Purchase order form; change notification sheet; tracer card; department complaint form

betical order. The large catalogs can be numbered in numerical sequence and kept in cabinets with shelves. A supply-catalog-file record index can be maintained on a 6 x 4 card. Catalogs should be indexed alphabetically both by manufacturers and by class of materials so that a catalog can be quickly located if either of these factors is known.

Purchase Order.—The purchase order must be signed by someone having authority to enter into purchase contracts for the institution. As indicated by his title, the purchasing agent is the officer to whom this function is delegated. The purchase order form should contain the terms and conditions and a sufficient number of copies should be available to supply each interested department with a copy.

Though the foregoing are the important forms their value is increased when they are supported by a change notification sheet, a tracer card, and a department complaint form.

Associations.—The buyer's ability to make a satisfactory purchase is limited to the sphere in which he travels. Provincialism should be avoided. Knowledge of what your fellow buyers in other parts of the country are doing and planning is essential to your success. Two worthy avenues are open through membership in the National Association of Purchasing Agents, 11 Park Place, New York 7, New York, and the Educational Buyers Association, 45 Astor Place, New York 3, New York. These are national organizations, as their names imply, and membership in them is worth many times the cost.

Reading Matter.—In this ever-changing and fast-moving world the buyer must keep himself informed by subscribing to services and publications applicable to the purchasing profession.

Service Depends on Policy, Foundation, Alertness

What particular products to purchase is for the buyer to decide. Having formulated policy, he lays his foundation, consisting of organization, procedure, legal status, departmental relationship, salesman relationship, quality, quantity, price, expediting, receiving, inspection, storeroom management, and surplus property disposal. The forms are the tools, and their efficient application necessitates staying abreast of trends as depicted daily, weekly, and monthly, in the publications pertinent to the educational field. For there is no short road to purchasing. On the contrary, there are basic fundamentals, and adherence to these determines satisfactory purchasing.

NOTE: The author wishes to acknowledge with appreciation the assistance obtained from Thomas D. Jolly, vice president, Aluminum Company of America, and the *Alcoa Purchasing Department Manual;* the *NAPA Handbook of Purchasing Policies and Procedure;* and Howard T. Lewis's book on industrial purchasing.

PURCHASE, CONSTRUCTION, AND USE OF SCIENCE LABORATORY APPARATUS

By HERMAN M. CAMPSEN, Jr.

Chairman, Physical Science Department, High School of Science, New York, N. Y.

Formerly Director of War Courses, New York City High Schools

THERE is no substitute for experimental observation in science teaching. Adequate provision for individual or group pupil work and teacher demonstrations must be made if real understanding of the subject is to be achieved and if pupils are to have well-rounded experience with the scientific method. Of course, laboratory work takes time and is not altogether inexpensive, but to curtail it is an unfortunate economy.

To secure both the initial equipment necessary and the supplies that will enable him to carry on, the science teacher must know the ultimate cost and utility of the equipment and supplies desired. Unless the science teacher can prove his needs, he will find it difficult to persuade the principal or superintendent to allot an adequate sum in the budget to the sciences. The average cost for laboratory supplies in schools that are well equipped appears to vary from $3.50 to $4.50 per student per year. When funds are insufficient, there can be little enrichment of the subject. Only mediocre science teaching is possible; an effective presentation is out of the question.

Teachers Should Prepare Own Supply Lists

It is hardly defensible to order supplies without definite knowledge of what is to be done with each piece. Each science course should be carefully planned. Before writing the requisitions, the experiments to be performed and the principles to be experimentally demonstrated should be determined. One must differentiate between pupil laboratory work, individual or group, and demonstrations to be performed by the teacher. The apparatus needed for the number of pupils to be taught must be ascertained. When there are several secondary schools in a city, the science departments of all the schools should pool data on the pupil average consumption for a number of years. This will avoid blind ordering from supply lists furnished by textbook authors who are well meaning but whose suggestions do not always fit local needs.

Materials should be requisitioned on the basis of standards or, where standards have not been developed, upon opinions of the department head and teachers. Again, when there are a number of secondary schools in a locality, a representative committee should be formed to study the specifications of laboratory supply manufacturers and make definite recommendations for the purchase of materials and equipment. This committee, with the aid of all interested science teachers, should develop a list of science supplies, from which all schools should make their requisitions. Standardization of size and quality of apparatus usually makes possible quantity purchases at lower cost, simpler inventory, and easier replacement and interchange of stock. To meet special requirements, science departments should be able to order outside of the list if adequate need can be shown. In New York City, the chairman of a standing committee on science works with the Board of Education Bureau of Purchase in formulating each year's science supplies list. Approval of the supplies list by the Board of Superintendents is required. The standing committee is composed of active supervisors and teachers of science elected to the committee by their subject-matter organizations; the committee chairman is appointed by the associate superintendent in charge of high schools.

Good science teachers make it their business to keep up with new demonstrations, experiments, and apparatus, by systematically attending professional conferences, encouraging the construction and use of home-made apparatus, and reading new books on the subject, advertising pamphlets and catalogs of scientific equipment manufacturers. Local and area science teacher associations, and principals and science supervisers, can do much to stimulate and inspire science teachers to improve themselves in service. Before the war, trips to different industrial manufacturing establishments could be arranged. Such visits, which enabled the science teachers to see the theoretical work of the classroom applied to industry, proved extremely interesting and worthwhile.

Quality and Price

It is frequently the practice of school systems to award contracts to the lowest bidding vendor. Acceptance of the lowest bid will not always result in the most satisfactory purchase, however. Although price is important, the decision should largely be based upon the quality of the goods, the reliability of the firm, and the service rendered by the firm. Science teachers or a competent school authority should inspect samples of the equipment and supplies under consideration. To become acquainted with the materials manufactured and the quality of the product, every opportunity should be seized to visit the factories of apparatus dealers.

Some Suggestions for Satisfactory Service

Materials delivered should always be carefully inspected in order to determine whether the goods received are of the same quality as the samples inspected. New supplies received should be checked against the requisition, and the department chairman should see to it that they are properly stored. Danger-

ous chemicals should be kept in a fire-proof basement storeroom.

As a general rule, equipment and supplies should be inspected systematically. A card catalog of all materials should be kept up to date, so that reference to it will make it possible to obtain materials for use in the shortest possible time. A continuing or perpetual inventory will aid in attaining efficient management of the department and will prove extremely valuable in purchasing new supplies. A "want book," in which teachers note equipment and supply requirements which cannot be satisfied when the need arises, is of great value when requisitions are made up.

Every science department should issue definite regulations to fix responsibility for loss, destruction, and theft of supplies. It is a good practice to hold pupils responsible for all breakage. No equipment should ever be stored unless it is in condition to be used again. Broken equipment should be repaired and worthless equipment should be discarded. Whether students are furnished with a partial set of apparatus at the beginning of the term, or whether apparatus is furnished as required each laboratory period, every teacher should check the equipment before and after use. Careful teacher supervision should also be exercised to prevent waste of consumable materials. Frequently an ounce of a substance is employed when a fraction of an ounce would accomplish the same result.

Obviously, adequate fire protection and safety precautions should be maintained at all times. At least one fire extinguisher and asbestos blanket should be provided in every laboratory, together with a carefully stocked first-aid cabinet.

Exploration in the Laboratory

Auditory and visual aids will frequently do much to stimulate discussion, creative effort, and exploration in the laboratory. The use of teacher or pupil-made models, specimens, slides, and motion picture films, as well as science radio programs, will stimulate interest.

An effective means of developing abilities and techniques in science among pupils is to coordinate and integrate shopwork with work in science. There is a very natural relationship in this regard, which is easily worked out. The shopwork teacher, who must have at least an elementary knowledge of science, instructs his pupils in the fundamental tool techniques. He then encourages them to develop the necessary skills by working on projects taken from the fields of science. These, of course, can be simple or complex, depending on the interest and abilities of the pupils. The pupils can make such items as test tube racks for

Photo by Esther Born, courtesy of Architectural Record

Science laboratory in the Acalanes Union High School, Lafayette, California, provides opportunity for experimental observations

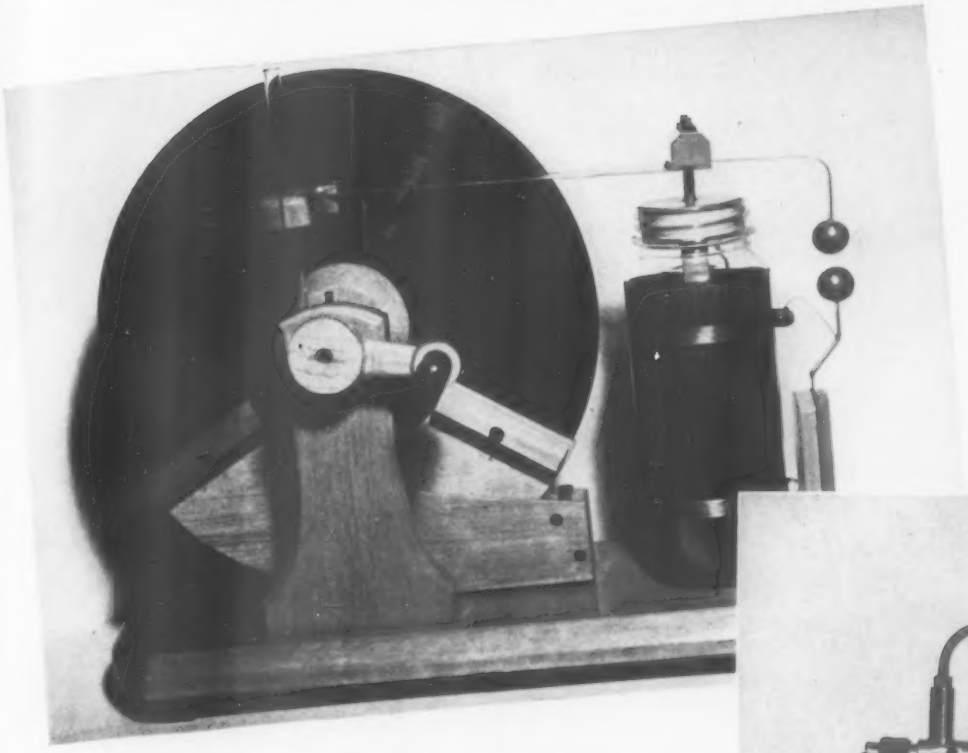
Left—An experiment in chemistry holds their interest

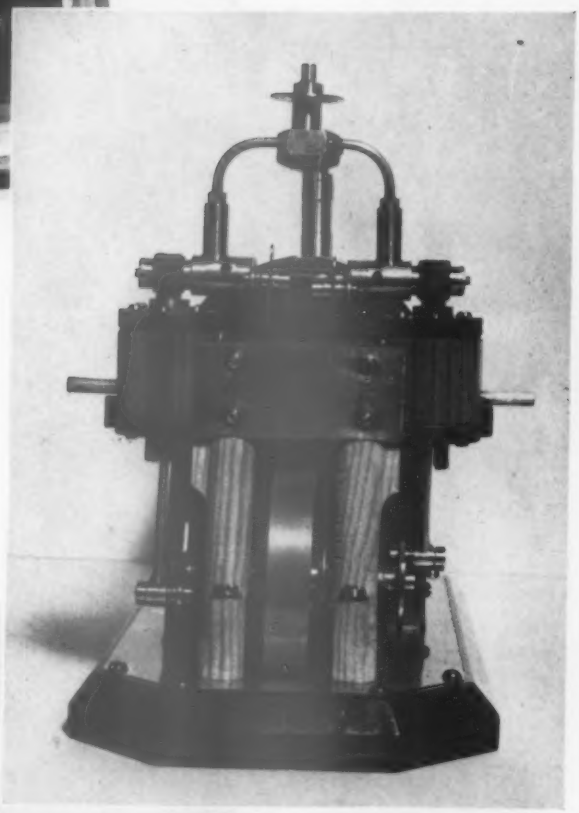
Right—The author demonstrates the mechanical advantage of a pulley system with the assistance of one of his pupils

the chemistry laboratory, light boxes for photography, motor and generator models for physics instruction, and cages for laboratory animals for biology, and they can assist in repairing and adjusting laboratory instruments and devices. Pupils frequently develop projects that could be the envy of professional science apparatus manufacturers.

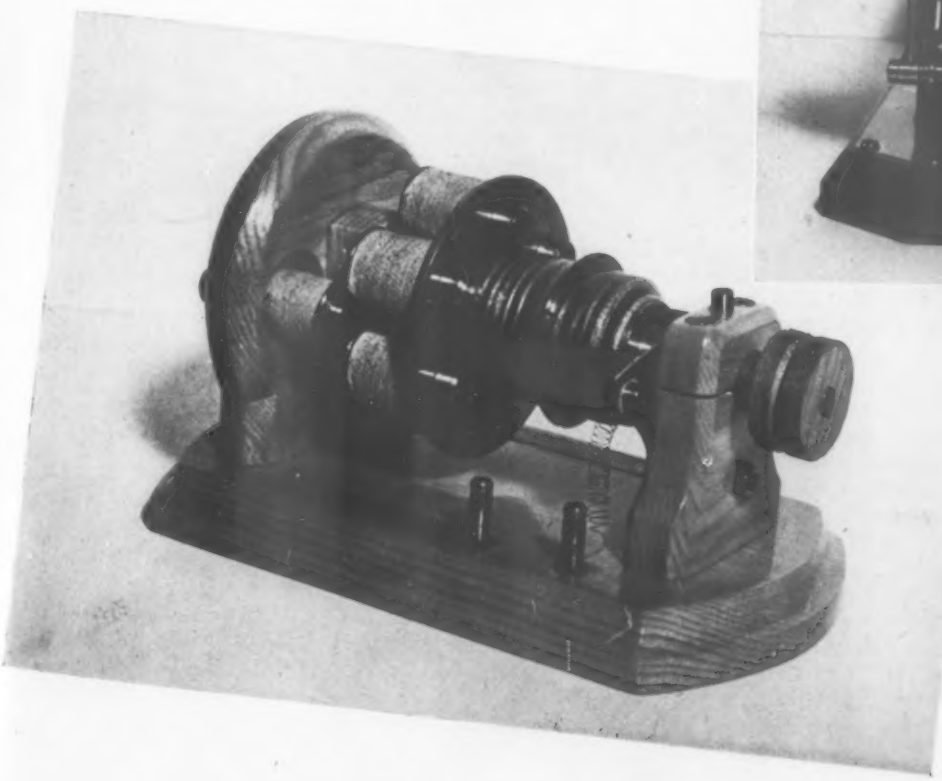
Science teachers themselves should know how to use the more common wood and metal-working tools. They should know how to use the lathe, the bench drill, breast drill, and stocks and dies. This knowledge and experience will enable them to easily devise and make apparatus for simple experiments. Frequently, apparatus is not commercially available and must be specially constructed.

In general, experiments should be provided which use apparatus which is simple, but not crude. In teacher demonstrations, the apparatus should be too large rather than too small. A demonstration experiment should aim to convey greater understanding of a scientific principle or show an application of a principle. If the experiment can be made to intrigue the pupil, arouse his curiosity, and make him do some reflective thinking, so much the better. However, no experiment should merely mystify the pupil. Although a good science teacher is frequently a showman, he is not supposed to be a magician who makes every effort to confuse and conceal. Whenever possible it is also a good idea to introduce the element of surprise into an experiment. A few experiments which pertain to the topic under discussion, carefully performed during the class period, are usually more effective than a great many which must obviously be rushed.





Examples of apparatus constructed by pupils in the Science Techniques Laboratory of the High School of Science, New York City. Above—Electrostatic machine. This apparatus was made principally from a peanut jar, a gasoline can, and old packing boxes. Right—Steam engine. Below—D. C. generator



A CONTINUOUS INVENTORY OF SUPPLIES AND EQUIPMENT

By GEORGE F. SMITH Jr.

Director, Educational Supplies and Equipment, Baltimore, Md.

IN its simplest form an inventory is a record of material in the possession of the owner. A continuous inventory is one which keeps this record up to date by posting additions and withdrawals at the time they are made and recording the balance.

The complexity of responsibilities of many organizations, requiring that information concerning certain details of their assets be available promptly at all times, has led to the development of the continuous inventory which can be designed to serve many different purposes. The importance to a school system of having current up-to-date inventory records is recognized by many and considered to be an indispensable part of their organization. School supplies and equipment are public properties representing cash values that must be accounted for under many different circumstances. They represent enormous investments in a multiplicity of items, and their values, quantities, locations, and characteristics should be available promptly for any emergency that might arise and for efficient and economical operation.

Factors Affecting Inventory Plan

The uses or purposes to be served by the continuous inventory have been variously stated. Some of the most pertinent are: control of school properties for general accounting; guide in purchasing for quantities to be bought in connection with annual needs; avoidance of unnecessary duplication; avoidance of obsolete and slow moving items; guide in replacements; maintenance and repairs of equipment; insurance adjustments in case of fire, theft, or misplacement; adjustments from other losses or damages.

The nature of the records, forms, and procedures for the continuous inventory of supplies and equipment will be determined by the uses that will be made of it, the general business and accounting set-up of the system, and the type of facilities available. For example, there is historically a lack of uniformity in the manner in which stock is accounted for. In some systems all purchases are thrown into stock immediately upon receipt, while in others only a part of the material bought goes into stock, the balance being handled as direct charges to schools. Some systems operate on the basis of expenditures, others account only for materials disbursed. These differences need not be discussed here, however, because they do not affect the general pattern for continuous inventories.

There are other factors to be considered. Some systems have centralized inventory controls, warehouse storage, and distribution of stock and operate entirely through the central office. Others have an inventory control operating from the central office, with warehouse facilities, but also carry a three or four months' stock in schools for use purposes.

It is doubtful, therefore, if any single inventory plan could be developed that might be applied to all school systems. Individual differences require adaptations to fit the particular responsibilities, facilities available, and methods of operation. It is thought, however, that certain underlying principles and minimum essentials exist that are common to all inventory plans.

Controlling Accuracy of Records

Provision should be made to check the accuracy of continuous inventory records by a physical inventory of stock on hand. This inventory may be taken complete as of any given period, or it may be taken as a continuous check, by which a physical count of a specified number of items is taken weekly, or a similar designated period, so that all items will have been checked within a definitely stated time.

A second control on the accuracy of the various operations of maintaining the continuing inventory, such as prices and extensions, is the book value of the inventory. Maintained by the accounting division, the book value reflects the money value of merchandise on hand for which the continuing inventory should account. It is frequently kept by classifications such as textbooks, classroom supplies, and hardware. The beginning inventory figure of the inventory account will be debited for all purchases for stock and credited with all withdrawals from stock. At the end of a fiscal period, where a plan of continuing physical check is in effect, or on completion of a physical inventory, the corrected inventory figures will be used as a basis of computing the valuation of the inventory. This valuation is then checked against the book value of inventory. Discrepancies should be handled, under careful supervision, by accounting adjustments.

Identification of Items

It is necessary that all items be identified. This should be done by an adequate but brief description. An item number is necessary for economical tabulating and ordering purposes.

Explicit information regarding the location of the item is required, i.e., warehouse number, school (number or name), repair shop, bin number, room number.

Each purchasing transaction should be identified either by order number, contract number, invoice number, contractor or vendor, or some other positive means for reference purposes.

Quantities received and disbursed must be recorded and the balance indicated. Old balances must be carried forward.

The date of each transaction must be shown, i.e., the date received or the date disbursed.

Units of purchasing, such as "each," "doz," "pair,"

"gross," and "lb.," obviously need to be indicated.

Unit prices must also be designated. For purposes of distribution it is frequently found that an average unit price is most convenient.

Inventory Forms

There should be a separate inventory record card or form for each kind of item. This record must provide at least for the foregoing minimum essentials. The design of the inventory is not important except that it should be large enough for many entries, in order to avoid excessive cards or record forms for the same item. The arrangement of the information on the form should be compact but easily read. The record form should be of a durable quality for frequent handling, of the visible index or similar type for economy of space and flexible and convenient use.

Provision must be made for transmitting to the proper officer or department the transactions that are to be posted to the inventory forms. Forms for this purpose are usually designated as receiving notices and removal notices. They are usually designed to serve several purposes, such as fixing responsibility for the proper receipt of materials and recording of information, fixing responsibility for properly filling and checking the orders, certifying that the school has received the material, etc. All other information required for the inventory record except, perhaps, the unit price is, of course, included on these forms. The forms are usually made up in several copies, depending on the uses to be made of them. Each copy is generally labeled to indicate the purpose it serves and its final destination, i.e., warehouse copy, school copy, office copy, certification, etc. The forms should be numbered serially for reference purposes. The various copies of the same form are frequently in different colors as an aid to quick recognition.

Principles in Operation

These principles will be discussed and illustrated in detail as they apply to the operations of a system which has an inventory control operating from the central office and warehouses for stock, with some stock carried in schools for use purposes.

Warehouse and Repair Shop Stock

The inventory cards (Fig. 1) showing stock of educational supplies, new furniture, and equipment on hand in the main warehouse—and the cards showing stocks of materials, supplies and equipment on hand in the repair shop—are kept in the central office. On the day that material is received at the *warehouse,* a "Report of Material Received" (Fig. 2) is prepared in triplicate for educational supplies and equipment. A separate set is prepared for materials received from each vendor or other source. The quantity to be placed in stock is shown in the "stock" column. The quantity for schools is shown in the "school" column. Quantities listed in the school column are not placed in stock but are accounted for by direct charges to schools. The original and duplicate of this report are forwarded to the central office and the triplicate is retained by the warehouse. A report is submitted for all receipts regardless of the source from which the material comes and the purpose for which it is delivered. Any material which is not placed in school bins immediately after being checked in is reported as received for stock, even though it may have been purchased for a particular school. The procedure for materials, supplies and equipment received in the *re-*

FIGURE 1

NUMBER DESCRIPTION BIN NO.

DATE	PURCHASED	ORDER NO.	WITHDRAWN	BALANCE	DATE	PURCHASED	ORDER NO.	WITHDRAWN	BALANCE	DATE	PURCHASED	ORDER NO.	WITHDRAWN	BALANCE
BALANCE ON HAND BROUGHT FORWARD					BALANCE ON HAND BROUGHT FORWARD					BALANCE ON HAND BROUGHT FORWARD				

DEPARTMENT OF EDUCATION
BALTIMORE

ORIGINAL

MAIN WAREHOUSE

Report of Materials Received

From

Rec'd by 19

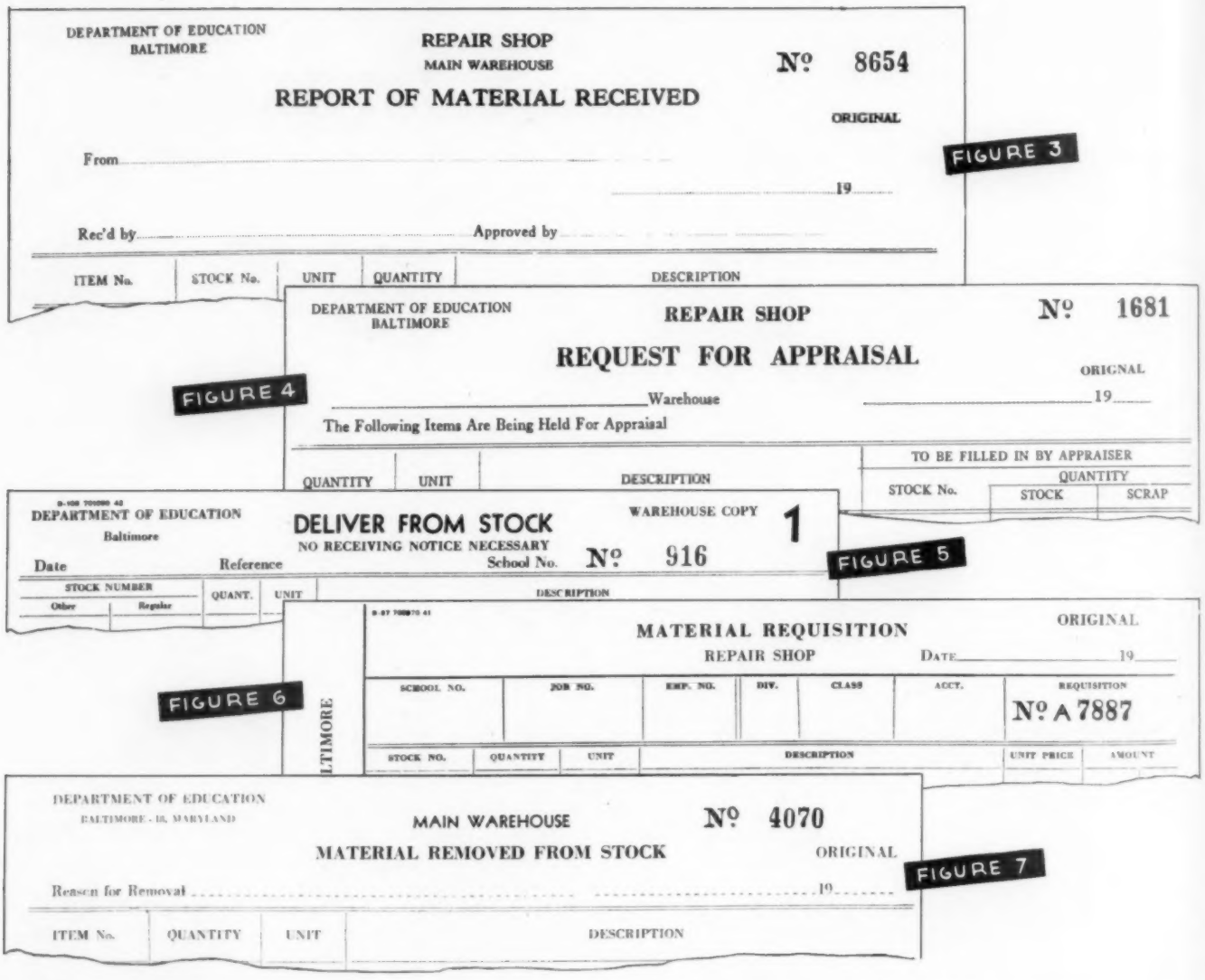
ITEM NO.	QUANTITY		UNIT	DESCRIPTION
	SCHOOLS	STOCK		

FIGURE 2

ORDER NO.	ENTERED ON CARDS	
		STOREKEEPER

This report must be prepared immediately upon receipt of material and be forwarded to the Business Office on the morning following the delivery to warehouse.

Figures 1 and 2—Inventory Card and Report of Material Received



DEPARTMENT OF EDUCATION
BALTIMORE

REPAIR SHOP
MAIN WAREHOUSE

Nº 8654

REPORT OF MATERIAL RECEIVED

ORIGINAL

From .....

19.....

Rec'd by ..... Approved by .....

ITEM No.	STOCK No.	UNIT	QUANTITY	DESCRIPTION

FIGURE 3

DEPARTMENT OF EDUCATION
BALTIMORE

REPAIR SHOP

Nº 1681

REQUEST FOR APPRAISAL

ORIGNAL

FIGURE 4

..... Warehouse ..... 19.....

The Following Items Are Being Held For Appraisal

QUANTITY	UNIT	DESCRIPTION	TO BE FILLED IN BY APPRAISER		
			STOCK No.	QUANTITY STOCK	QUANTITY SCRAP

DEPARTMENT OF EDUCATION
Baltimore

DELIVER FROM STOCK

NO RECEIVING NOTICE NECESSARY

WAREHOUSE COPY 1

Date Reference School No. Nº 916

FIGURE 5

STOCK NUMBER Other	STOCK NUMBER Regular	QUANT.	UNIT	DESCRIPTION

MATERIAL REQUISITION

ORIGINAL

REPAIR SHOP DATE ..... 19.....

FIGURE 6

SCHOOL NO.	JOB NO.	EMP. NO.	DIV.	CLASS	ACCT.	REQUISITION
						Nº A 7887

STOCK NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT

DEPARTMENT OF EDUCATION
BALTIMORE 18, MARYLAND

MAIN WAREHOUSE

Nº 4070

MATERIAL REMOVED FROM STOCK

ORIGINAL

FIGURE 7

Reason for Removal ..... 19.....

ITEM No.	QUANTITY	UNIT	DESCRIPTION

Figures 3, 4, 5, 6, 7—Report of Material Received (Repair Shop); Request for Appraisal (Repair Shop); Deliver from Stock; Material Requisition (Repair Shop); Material Removed from Stock

pair shop is approximately the same as that for warehouse except that a slightly different "Report of Material Received" form is used (Fig. 3). Used furniture, equipment brought in from the school for repair and returned to the school, is not reported on this form if a repair order has been issued on it at the time it arrives at the repair shop. Used furniture and equipment that has been covered by a repair order and is being repaired for stock is reported to the central office on the regular form for material received when the order is completed and placed in stock.

All equipment and supplies returned to the warehouse from schools are segregated, and "Request for Appraisal" (Fig. 4) is prepared in triplicate. Two copies of this request are sent to the central office, the materials or equipment are inspected by a representative from the central office, and one copy of the form is returned to the warehouse showing the quantities, item numbers, and descriptions of those items which are to be placed in stock, and the quantities and descriptions of the items to be scrapped. A "Report of Material Received" is then issued for the former items.

When the reports of materials received have reached the central office, the quantity shown in the stock column is posted as additions to stock on the inventory cards. Quantities shown in the school column are not posted to the inventory cards as those quantities are placed in school bins for delivery to the schools. One copy of the "Report of Material Received" serves as the official receiving notice and is used by the accounting department for comparison with contracts and audits.

Upon receipt of properly approved requisitions for withdrawal of additional materials from the warehouse, the central office prepares a set of forms, "Deliver from Stock" (Fig. 5), authorizing the warehouse to make delivery to the school or other designated place. These forms are prepared in quadruplicate. Copies 1, 2, and 3 are forwarded to the warehouse; copy 4 is held at the central office until copy 3 has been returned by the warehouse; copy 1, the warehouse copy, is retained permanently by the warehouse; copy 2 goes to the school with the delivery of the material and is retained by the school as their copy;

copy 3 is the school's certification copy, indicating material has been received; copy 4 is the central office copy. Upon receipt of copy 3 from the warehouse, properly certified that the material has been received by the school, it is matched up with copy 4 and the quantity shown as having been withdrawn is posted to the cards. These forms are used only for incidental requisitions and do not cover materials delivered from warehouse stock on annual requisitions. After having been entered on the inventory cards, priced and extended, copy 4 is used for accounting purposes.

Reports of "Material Removed from Stock" (Fig. 7) are issued by the *warehouse* showing materials and supplies delivered from stock on annual requisitions or removed from stock on account of breakage, obsolescence, or any reason other than a regular requisition. All such reports must be properly approved by the central office before becoming valid, except of course, those for stock withdrawn for annual requisitions, for which approval has already been received. The quantities shown on these reports are then posted to the inventory cards as deductions from the inventories.

Withdrawals from stock in the *repair shop* are made on the authority of the central office by means of repair shop orders based on properly approved requisitions. Upon receipt of these repair shop orders a "Material Requisition" (Fig. 6) is issued in quadruplicate for any materials needed for the repairs authorized. These material requisitions are issued and approved by the supervisor of the repair shop. The various copies are handled in a similar manner to those issued for the withdrawal of educational supplies from the warehouse.

On the first working day of each week a physical count of not less than twenty items of stock is made by the *warehouse*, and the report of the actual quantities on hand is forwarded to the central office. These items are reported on a form designated "Report of Inventory Check" (Fig. 8). When this report has been received at the central office, it is compared with the quantities shown on the inventory cards and, after investigation and approval, corrections and adjustments are made if any discrepancies exist.

In case it becomes necessary in an emergency to deliver any material on a verbal order, a record is made by the warehouse, and the central office is notified by telephone immediately. The central office then, upon proper approval, prepares a written authorization for the delivery on the regular forms, marking them "confirmatory." For convenience in checking and distributing supplies, the warehouse and repair shop maintain in-stock index cards designated as "Bin Cards" (Fig. 9).

Hand vs. Machine Methods

While hand inventory methods may be the rule in the small school systems, these methods have definite drawbacks and limitations, especially as applied to larger systems. In the first place, there is little check against errors in the unit prices, extensions, and additions, except by a duplication of work. The second disadvantage lies in the fact that it is not customary by hand methods to keep a valuation figure in dollars of the balance on an item card. Such valuations for purposes of comparison with the book value of inventory must be computed at stated periods as required. Hand methods also have disadvantages as to economy of effort in extensions, additions, and posting entries.

Because of the disadvantages listed above, most of the larger systems adopt machine methods for keeping

B 71 MDB 1793

DEPARTMENT OF EDUCATION
BALTIMORE

ORIGINAL

.....WAREHOUSE

FIGURE 8

REPORT OF INVENTORY CHECK

.....19.....

An Actual Count of the Items Listed Below Showed the Following Quantities in Stock

Last Requisition Filled No.....Last Receiving Notice No.....

ITEM No.	UNIT	QUANTITY		ADJUSTMENT		DESCRIPTION
		COUNT	CARDS	SHORT	OVER	

B-84 7-34

FIGURE 9

BIN NO.

Stock No.....Unit.....

Description.....

DATE	ORDER NO.	SCHOOL NO.	FOR STOCK	WITHDRAWN	BALANCE

Figures 8 and 9—Report of Inventory Check and Bin Card

of inventories. Where the plan is so set up that extensions and additions are handled by such means as tabulating machine equipment, the actual posting to inventory records may be done by standard types of bookkeeping equipment. Where problems of extension and addition are concerned, there are great advantages to be had from equipment in the nature of combination typewriter-calculator-accounting machine equipment. Such equipment provides for posting an unextended requisition or withdrawal transaction to the stores ledger or continuous inventory, valuing the "on hand quantity," entering on the requisition the value of the stock disbursed, and proving that the work was done correctly. The record maintained by this machine will give not only the quantity of an item on hand but the total value of that quantity. This method has distinct advantages in greater proof of correct pick-up of unit costs, correct extensions, etc.

Reducing Number of Withdrawal Postings

In the larger school systems the task of maintaining continuous inventories of stock items becomes almost impossible because of the volume of work, unless some plan is adopted for reducing the number of withdrawal postings. Under some inventory systems, a withdrawal entry on a card is required for each item ordered by each school. In other words, if 150 schools order the same item, 150 entries must be made. Some school systems have developed methods of reducing the number of such withdrawal postings. In general, these methods fall into two classes:

1. Where periodic requisitions are received from schools on a quarterly, semi-annual, or annual basis, they are tabulated and the total quantity of each item ascertained. A single withdrawal posting on the inventory card, noted "semi-annual requisitions," will cover the withdrawals of that item for all schools. In other cases, where definite quantity contracts are awarded to fill the requisitions, the amounts requisitioned will be put directly into school bins at the warehouse and charged directly to schools on the basis of distribution sheets, without being thrown into stock and withdrawn from stock. The only entries on the stock card would be (a) additional quantities bought for stock and (b) quantities withdrawn from stock in lieu of purchase, to fill the annual requests. This method has a disadvantage in that the total purchases and usage are not reflected on the inventory card, and a separate "use" card must be maintained.

2. Instead of individual withdrawals for each order or a requisition, the orders for a given period, possibly one month or two months, are tabulated and the total withdrawals of an item for that period handled by one entry; e.g., "January orders."

The operation under the foregoing plans (1) and (2) is greatly facilitated by the use of tabulating machines to secure total quantities by items and distribution of costs by schools.

Miscellaneous Equipment Procedure

In addition to the inventories for supplies and equipment in the warehouse and repair shop, continuous inventories are maintained in the central office for various types of portable equipment located in schools where there is more than a reasonable risk of a loss from theft, damage, and misplacement. An additional purpose of this inventory is accounting for maintenance of the equipment.

Some of the types of equipment included in these inventories are typewriters, office practice machines, microscopes, visual educational equipment, sewing machines, and stop watches. The procedure for repairs to this type of equipment is similar to that followed for work done in the repair shop. The job orders are based on approved requisitions from the schools and the detailed information provided for on these inventory records is similar to that provided for on the regular stock inventory records, with the addition of supplemental provisions for data pertaining to the repairs. Cross references are kept by serial number and location of this equipment. The operations for these inventories can be best illustrated by the plan followed for the typewriter repairs. Two types of inventory record cards are used, one designated as the "Typewriter Transfer Card" (Fig. 10), the other "Typewriter Record Card" (Fig. 11). These are tabbed, one-fifth cut index cards, using first, third, and fifth positions. Each card has spaces provided for the school, room, desk, and serial numbers; make, kind of type, age, date of inventory. The "Typewriter Transfer Card" is used for several purposes: as a record by serial number and location of all machines in the possession of the school system; as a record of the change in location, i.e., either permanent transfers or temporary transfers to the typewriter repair shop for repairs or other purposes; as a cross reference with the "Typewriter Record Card" file. The serial number is indicated on the tab. The cards are filed by make of machine in numerical order of serial numbers. When a typewriter is transferred from a school, the posting is done when the transfer has been completed, on the basis of information on the copy of the transfer order returned to the central office. The column headed "To T.R.S." is the typewriter repair shop column. The date of the transfer is posted in this column and the column headed "To School." These cards are retained in the file in the order indicated above; that is, by make and serial number. Cards withdrawn for posting are returned to the file in their original place.

The "Typewriter Record Card" is filed by school number. The school number is indicated in the space provided for "School No." and also on the tab. Spaces are provided on these forms for recording in detail the cost of repairs and replacement parts for the typewriters. These cards are posted from the copy of completed job order returned to the central office by the typewriter repair shop. These cards move with the machine—that is, if a machine is transferred permanently from one location to another, the card is removed from its old location in the file to the new one and the tab on the card is changed accordingly. This procedure is also followed when typewriters are moved from their permanent location to temporary locations, such as to the repair shop for repairs or to another location for loan, or vice versa. Sections are set up in the file for such temporary changes in location; as an example, one section is labeled "Typewriters on Loan," another "Typewriters in Repair Shop." This record serves several interesting purposes. For example, the percentage of typewriters in a system by age can be quickly ascertained. This

FIGURE 11

TYPEWRITER RECORD CARD

School No. _____ Room No. _____ Desk No _____

Serial No. _____ Model No. _____ Make _____

Type _____ Age _____ Date. (Of Inventory) _____

ELITE OR PICA — TO BE FILLED IN BY B. O.

Remarks: _____

DATE	JOB NO.	TIME HOURS	TIME COST	MATERIAL PART NO.	MATERIAL COST	TOTAL COST	GRAND TOTAL	DATE	JOB NO.	TIME HOURS	TIME COST	MATERIAL PART NO.	MATERIAL COST	TOTAL COST	GRAND TOTAL

FIGURE 10

TYPEWRITER TRANSFER CARD

B-141 701610 40

School No. _____ Room No. _____ Desk No. _____

Serial No. _____ Model No. _____ MAKE _____

Type _____ Age _____ Date (of Inventory) _____

DATE AND REQUISITION NUMBER OF TRANSFER TO REPAIR SHOP AND BACK TO SCHOOL

To R. S.	Req. No.	To School	Req. No.	To R. S.	Req. No.	To School	Req. No.

Figures 10 and 11—Typewriter Transfer Card and Typewriter Record Card

information is invaluable in considering expenditures for replacement. Adjustments also can be made quickly to meet changes in enrollment. The repair costs also are indicative of the treatment the machine receives, i.e., if the costs should appear to be excessive, an investigation can be made quickly to determine the cause.

Valuable information with regard to possible vandalism or other misusage or unusually good usage in various schools is revealed. All supporting data pertaining to transactions concerning each typewriter are filed with this card.

Inventories Within a School

Continuous inventories within a school are designed to provide current information regarding supplies and equipment permanently assigned to schools or used up within the school term. The items consist of furniture, large equipment (power machinery, for example), general classroom supplies, books, janitorial supplies, etc. Many school systems would not consider it desirable to maintain continuous inventories of furniture and large equipment in the central office since items of this nature could not be easily removed, and the danger of removal or misplacement without authority or misappropriation is negligible. However, requirements for insurance purposes make a centralized inventory of equipment of greater importance in some systems. In the absence of a central inventory, it is considered highly desirable to have the inventory in the school kept up to date in regard to types of equipment, quantity, and locations, and schools are required to have such an inventory available at all times.

Continuous inventory records of perishable supplies and equipment used in classroom, however, are desirable for certain types of items because of the problems of storage and distribution within the school. For example, it is particularly important to have rather exact records of the distribution of books within a school, not only for distribution purposes within the school but for ordering on annual requisitions. For many items, it is, perhaps, desirable to take inventory of these items only once a year, especially when the main objective is ascertaining annual needs. When the principal purpose of a continuous inventory of supply item is to build up a "use record" in the schools as a basis of intelligent ordering, this result can be accomplished with less effort by maintaining a continuing record of the periodical physical inventories, including a record of amounts ordered, from which is computed the amount used for a given period.

Three special forms are used for such purposes. These are indicated "Inv. 1," "Inv. 2," "Inv. 3," and "Inv. 5" (Figs. 12, 13, 14, and 15). Figs. 12 and 13 are identical except that they are in two sizes, Fig. 12 being a single card and Fig. 13 a twofold card. These two forms are used for classroom and janitorial supplies and small equipment. Fig. 14 is used for books and small equipment (tools, drawing instruments, etc.) that are loaned out, to classes usually, and returned at the end of the semester or course. Fig. 15 is used for furniture and large equipment and pro-

FIGURE 12

ITEM NO. | UNIT | DESCRIPTION | LOCATION

Date	REQUISITIONED		Quantity Received	WITHDRAWN		BALANCE	
	How	Quantity		How	Quantity	Unsatisfactory	Satisfactory

Date	REQUISITIONED		Quantity Received	WITHDRAWN		BALANCE	
	How	Quantity		How	Quantity	Unsatisfactory	Satisfactory

FIGURE 13

ITEM NO. | UNIT | DESCRIPTION | LOCATION

Date	REQUISITIONED		Quantity Received	WITHDRAWN		BALANCE	
	How	Quantity		How	Quantity	Unsatisfactory	Satisfactory

Date	REQUISITIONED		Quantity Received	WITHDRAWN		BALANCE	
	How	Quantity		How	Quantity	Unsatisfactory	Satisfactory

FIGURE 14

FIGURE 15

Size	Description of Motor
Model	Make
Manufacturer	Serial No.
Mfg. No.	Type of Starting
Mfg. Cat No.	R. P. M.
Serial No.	H. P.
	Current
	Phase
	Cycles
	Voltage

INV-6 607080 43

FIGURE 16

Department of Education – Division of Vocational Education – Baltimore, Maryland

Continuing Inventory of Supplies

Item_____ Shop_____

Kind_____ School No._____ Department _____

DATE	SIZE	ITEM NUMBER	AMOUNT WITHDRAWN	ISSUED TO	BALANCE	DATE	SIZE	ITEM NUMBER	AMOUNT WITHDRAWN	ISSUED TO	BALANCE

INV. 2

INV. 7 607070 40

FIGURE 17

Department of Education – Division of Vocational Education – Baltimore, Maryland

EQUIPMENT INVENTORY

(See other side for power machinery)

Item_____ Shop _____

Mfg._____ School No._____ Dept._____

Date Rec'd	Size	QUANTITY		Model	Mfg. No.	Date or No. Mfg. Cat.	AT CLOSE OF SCHOOL YEAR		
		New	Used				Unfit for use	Lost	Total in good condition

Figures 12, 13, 14, 15, 16, 17 (page facing)—Inv. 1 (maintained by school); Inv. 2 (maintained by school); Inv. 3 (maintained by school); Inv. 5 (maintained by school); Continuing Inventory of Supplies; Equipment Inventory (maintained by school)

vides for information pertaining to motorized equipment. While provision is made for distribution of items recorded on these forms, in most cases the items are of a type that would not be distributed and few, if any, other than the original entries are recorded. In schools, the principal is the responsible officer for maintaining these records. Once a year, in normal times, the supply and equipment supervisors "spot" check the schools, going unannounced directly to the school to examine the records and make comparisons and checks against the storeroom and classroom stocks and building equipment. When it is deemed advisable, a complete physical count is made. Such checks have resulted occasionally in bringing to light surplus stocks or unused stocks that have deteriorated because of failure to have them put into use at the proper time. Since these continuing inventories have been in use, however, the problems of surplus and deteriorated stock have been almost entirely eliminated. Provision is made on the annual requisitions, by special forms, for having the schools report surplus and obsolete items. These are picked up, appraised and, when found usable, returned to warehouse stock.

In addition to the foregoing forms, separate forms have been provided for all shops under the supervision of the Department of Vocational and Industrial Arts. These forms are designated as follows: "Continuing Inventory of Supplies" (Fig. 16) and "Equipment Inventory" (Fig. 17). The items recorded on these forms are not duplicated on any other stock forms and, even though the items are maintained in the school where the principal is the responsible officer, they are under the supervision of the Vocational and Industrial Arts Division. Physical checks are made by the supervisors from the central office of this division at least once a year, frequently twice a year. Because of the highly specialized nature of these items, it has been found more desirable to segregate the records from those of items in general use. Slightly more detail is provided for to meet special needs for replacement, distribution, and life of service.

Order Department, Alderman Library, University of Virginia

BUYING BOOKS FOR THE LIBRARY

By JOHN VAN MALE

Librarian, University of South Carolina, Columbia

BOOK ordering is the business phase of librarianship, the place where the library and the book trade meet. The order librarian spends most of his time on paper work, keeping account of the money he has spent, corresponding with booksellers, and bringing his records of unfilled orders up to date. Since he stays behind the scenes among filing cases and typewriters, he looks more like a bookkeeper than a librarian. Unlike the rest of the staff, who work with books or people or both, he works with cards representing books not yet in the library and with orders and letters to people far outside the building. Despite appearances, the book buyer has an interesting job, whose endless variety demands skill and resourcefulness.

Trade Bibliographies and Search for Materials

The order librarian buys a highly variable commodity, which may be divided into books, pamphlets and serials. Books often appear in several editions, each a little unlike the other. Bound books survive many changes of ownership, but pamphlets tend to disappear when wanted. Serials include newspapers, magazines, and the publications of government offices and private associations. Since libraries prefer to own complete files of serials, the order librarian continually searches for missing numbers. One of the more perplexing features of printed materials is that they are published almost anywhere. In America many individuals and associations, taking advantage of the freedom of the press, publish items of more than local interest but make no effort to distribute them.

Trade bibliographies bring order into the chaos of new publications, especially in this country where the *Cumulative Book Index* and certain specialized periodicals, listing publisher and price, report practically every new piece of print a library wants. The reporting of foreign books and governmental and other serials could be improved, but on the whole the job is done well enough to meet the needs of most libraries. The trade bibliographies list only new publications, of course. When the publisher's supply is exhausted, no one can say with certainty where

copies can be had. However, out-of-stock copies can sometimes be found at bookstores, or photographic copies obtained from libraries.

Dealings with the Book Trade

The order librarian seeks to buy as quickly and cheaply as possible. If speed is important, he usually orders direct from the publishers. Doing so makes the cost of ordering rather high, since an order goes to each publisher, and the library must ask each publisher separately to adjust errors in shipment or billing. When the books arrive, many invoices must be checked and passed for payment. Publishers allow libraries comparatively small discounts as a general rule. What the library gains (theoretically) in speed of delivery is offset by increased clerical costs and a fairly high average cost per book.

Many libraries, especially public and school libraries, order through a local bookstore, often because the board requires them to do so, but sometimes because the librarian prefers it. Whether or not this is good practice has long been debated and probably will continue to be for years to come. The local dealer usually sells books on approval, and he can often supply the newest, popular books from stock. These advantages, great though they are, must be

A book jobber's storage stacks. Purchasing books through a jobber has many advantages: higher discounts, lower clerical costs, better service on out-of-the-way and out-of-print items

Courtesy Baker & Taylor Co.

weighed against higher costs per book. Unless he is prepared to lose money, a local bookseller must sell at low discounts. The library must also expect poor service on out-of-the-way publications from a local dealer, who seldom if ever has the staff and experience to order them efficiently. Librarians who prefer to buy locally explain that in so doing they support a cultural institution which reinforces the library's aims. In other words, the library subsidizes the bookstore. Has it the right to do so unless publicly authorized by the city council or the school board? If these authorities approve, they should enter the subsidy in the budget, in fairness to the taxpayer. Needless to say, no bookstore is openly subsidized.

Most order librarians, and in fact many bookstores, order from a wholesale house. The clerical costs of ordering through a jobber are low, because the library sends one order instead of many; the jobber adjusts errors which the publishers commit, and the librarian checks one bill instead of several when the books arrive. Strange to say, the jobber often deducts a higher discount from the price of the book than the publisher would. He can do so because the publishers allow him much larger discounts, as manufacturers customarily do in selling to wholesalers. Buying from wholesalers has its dangers, if the librarian patronizes one dealer too faithfully. By shopping around now and then he may obtain better discounts. He may also obtain better service. Like other business firms, book jobbers have their ups and downs, performing very well one year and not so well another year.

Large libraries seldom rely entirely on one agent to supply their wants. The small library finds it wise to order all books from one dealer, because its business counts for more if not divided, and because one dealer can supply everything it orders. The small library buys few books not in print, and if out-of-print, the book is usually well known and easily obtainable. Many dealers are qualified to handle this type of business. Large libraries acquire proportionately many more out-of-the-way and out-of-print items than small libraries do and therefore require specialized service, which they obtain by dividing their business among the dealers experienced in handling various types of publications. They also buy at random from rare-book dealers, whose catalogs the librarians scan to locate unfilled wants and to build up special collections. As a general rule, the larger the library the more sources of supply it uses in meeting its needs. Large university libraries even call upon their alumni for help in acquiring out-of-the-way publications.

In their dealings with the book trade, libraries have worked out standard order routines, which are described in detail in F. K. W. Drury's text, *Order Work for Libraries* (Chicago: American Library Association, 1930), now out of print, and more briefly, but well, in L. F. Fargo, *The Library in the School*, 3d ed., (Chicago: American Library Association, 1939), Chapter 12, Martha Wilson, *School Library Management*, 6th ed., rev. by A. M. Currin (New York: H. W. Wilson Co., 1939), Chapter 11, and M. P. Douglas, *Teacher-Librarian's Handbook* (Chicago: American Library Association, 1941), Chapter 4. Order routines, at their simplest, consist of keeping a file of carbon copies of the orders sent to the dealers. Most librarians also fill out order cards (printed forms can be ordered from supply houses) for an alphabetical file of outstanding orders. The order cards are then sent along with the books to the catalogers.

Acquisitions by Gift and Exchange

Libraries acquire books not only by purchase but also by gift and exchange. Large and old libraries receive in these ways a rather large proportion of their books and periodicals. Smaller and younger libraries tend to examine gift horses' mouths critically, since librarians now plan their book collections to fit definitely known needs. Large general libraries cultivate gifts and exchanges as a means of supplementing a book budget which always seems too small. The large library's friends sometimes provide expensive books or special collections. By exchanging duplicates and its own publications with other institutions the large library procures, at a low cost, publications which would otherwise be hard to find.

Book Purchasing Agreement

Except in their exchange relationships, libraries have only begun to coöperate with one another in acquiring books. Several proposals for coöperation have been advanced, some patently unworkable but others at least worth trying. A central order office for all libraries has been proposed again and again. So long as the book trade continues to render adequate service, few librarians feel inclined to set up a jobbing firm of their own. A halfway measure, which brings about joint action without disrupting the book trade, is the book purchasing agreement. This device, used by certain Western libraries since 1940, consists of asking jobbers to bid for the orders of a group of libraries. The libraries promise to place a certain amount of business with the successful bidder, who is chosen on the basis of both the discount he offers and the service he is known to render. The libraries make him in effect their central purchasing agent. Instead of suffering from the inexperience of a newly-established office of their own, they benefit by the experience of an old firm. The jobber obtains a steady flow of business without soliciting it.

Whatever its merits, the book purchasing agreement points out once again that coöperation is desirable and workable. American libraries buy several million dollars' worth of books a year, but the enormous economic power of these purchases is dissipated so long as each library goes its own way in acquiring books. The very peculiarities of library book needs call for coöperation, in order to obtain the most effective service. No one commercial agency is equipped to render all-round service. American libraries, acting together, could either establish agencies of their own for acquiring the types of publication most difficult to locate or, by pledging enough business to certain dealers to make greater specialization profitable, ensure the development and continuance of commercial agencies closely adapted to library requirements. Coöperation in cataloging, reference service, and interlibrary loans has worked so well that rugged individualism in library book-buying has become an anachronism.

WHAT SHOULD OUR AUDIO-VISUAL PROGRAM PROVIDE?

By HELEN HARDT SEATON

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THE American Council on Education published, in October 1944, a set of basic recommendations for the development of audio-visual programs in schools.[1] We feel that these recommendations constitute a milestone in the road of progress. This is a first attempt to set down in the form of specific recommendations a comprehensive plan for development of audio-visual programs on all organizational levels.

Not long ago at an informal meeting at which a proposed teaching unit of Kodachrome slides was shown, the head of a teacher training institution and an educational research man of some renown spoke at considerable length of the value of the Kodachrome unit as "supplementary" and "enrichment" material. These terms are still frequently applied to audio-visual materials of all types. Perhaps these are merely clichés which skip from the tongue with more speed than precision. I am afraid not. That the American Council on Education has published basic recommendations for the development of audio-visual programs indicates that, in certain educational circles at least, audio-visual aids are beginning to attain their proper position as primary, basic, *teaching* materials.

Any person or organization which goes on record with concrete recommendations in a field where philosophy and practices are so little standardized goes out, not on the proverbial limb, but on a whole series of limbs. However, the same situation that makes the undertaking so hazardous, defines the need for the attempt. In the preparation of the recommendations the Council was extremely fortunate in securing the coöperation of a group of persons of outstanding ability and achievements in the field of audio-visual education: Walter S. Bell, Floyde E. Brooker, James W. Brown, Alvan L. Chapman, Elizabeth Goudy, Gardner L. Hart, Charles F. Hoban, Jr., Francis W. Noel, George Ormsby, and Paul C. Reed. Their experience, drawn from school situations, research, and war service proved invaluable in focusing attention on all phases of our problem and in reaching recommendations in line with the best thinking in the field. Surprisingly little trepidation, therefore, accompanied the release of the final revision of the recommendations.

Equipment—Goal, Not Absolute Minimum Listed

Without doubt the section of the recommendations which will draw the most comment is that which lists the minimum goal for equipment in the individual school:

One 16-mm. sound projector for every 200 students *
One filmstrip projector for every 200 students *
One 2 x 2 projector for every 400 students *
One 3¼ x 4¼ projector for every 400 students *
One set of 35 stereoscopes for every 400 students (elementary schools only) *
One opaque projector for each school
One table-type radio for each classroom
One two-speed, portable 16-in. transcription player (complete with speaker) for each 200 students *
One microphone for use with playback or projector for each school
Wall-type screens or suitable projection surface for each classroom

* Or one per building where enrollment is less than the number specified.

Although care has been taken to emphasize that this is a *minimum goal* rather than an absolute minimum, it will almost surely be misinterpreted by some. Unfortunately, the listing of an absolute minimum such as might be provided for a first-aid kit is impossible with the diversity of conditions to be met. Local conditions and needs, the accessibility of materials of various types, and the extent of financial support for the audio-visual program provide the only satisfactory basis for determining in what direction a start will be made and in what order and quantity the foregoing equipment will be secured. The recommendations go on to indicate additional audio-visual equipment which might logically be acquired after the minimum goal is reached.

Basic Factors Reemphasized

Although the recommendations dealing with the minimum equipment goal may be expected to draw the most attention, in reality the underlying principles set forth in the sections dealing with the functions of a department of audio-visual education and with the relations of departments or service units on various organizational levels are of greater lasting significance.

In simplest terms any audio-visual program should provide the greatest possible amount of relevant materials of high quality, the maximum assistance to teachers in the use of these materials, and the maximum number of mechanical reproducers, consonant with the balanced provision of all types of materials of instruction, within the limits of the funds available.

This statement assumes a number of the more specific points dealt with in the recommendations recently published. To some the following discussion may seem too elementary, but disregard of the simplest, most obvious, basic factors is the reason for the singularly ineffective programs now in existence in many places. Briefly, some of the more important points brought out are:

The school system must recognize the importance of audio-visual materials in securing effective teaching.

It must consider audio-visual aids as valued members of the family of instructional materials and recognize the need for the close coördination of all ad-

[1] *A Measure for Audio-Visual Programs in Schools* (Washington, D. C.: American Council on Education, 1944).

"The school system must admit the importance of selecting materials in terms of curricular needs"

ministrative units having to do with materials of instruction.

The school system must admit the importance of selecting materials in terms of curricular needs and practice such selection.

It must assume the responsibility of providing assistance to teachers in the utilization of audio-visual materials.

It must procure quality materials for use in the classroom.

It must provide adequate equipment for the presentation of the audio-visual aids.

Planning and Service of Central Department

In order to assume effectively the foregoing responsibilities and to perform the functions inherent in them, it is evident that a centralized program and administering unit is essential. In its recommendations the American Council on Education has chosen to divide the functions of the central department into two categories—planning and service.

a. Planning functions . . . should include:
Integration of audio-visual materials into the curriculum
Correlation of audio-visual materials with other teaching materials
Promotion of the use of audio-visual aids
Improvement of the utilization of audio-visual materials
Organization and guidance of the activities of the audio-visual coördinators in each school
Responsibility for securing evaluation of materials prior to purchase and during regular use after purchase
Participation in curriculum revision
Provision for and participation in community-wide utilization of audio-visual materials
Interpretation of audio-visual education to the board of education, superintendent, and the community
Informing producers of needed audio-visual materials.

* * * *

b. Service or operating functions which . . . include:
Responsibility for advising on the equipping of existing buildings
Advising on the construction of new buildings in terms of the needs of the audio-visual program
Purchase of equipment
Procurement and distribution of materials for in-school and community use
Responsibility for the training of teachers and students in the operation of equipment
Provision for repair and maintenance of equipment and materials
Preparation of catalog and teaching guides.

Personnel

The folly of turning over the position of director of such a unit to a person of little training and experience is self-evident. The Council makes strong recommendations for the provision of qualified personnel to direct the audio-visual work.

Adequate staff assistance should be provided to carry on all of the functions of the department. . . .
Audio-visual supervisory personnel should have (a) an aptitude for and experience in teaching, supervision, and administration, (b) a sound background in curriculum planning, (c) a broad practical experience in the utilization of audio-visual materials, and (d) a working knowledge of audio-visual equipment.

Budgetary Allowances

The Council's position on the importance and organization of the audio-visual program presupposes financial support of a continuing and substantial nature. Recommendations in this section may well be brought to the attention of school boards which have not consistently seen the need for annual appropriations of a size which would allow long-term planning and sound development of audio-visual programs in the past.

1. The audio-visual program should receive regular financial support commensurate with its importance. Budgetary allowances for the audio-visual program should be planned and drawn up in coöperation with the director of audio-visual education.
2. Budgetary allowances for audio-visual *materials* should

"... audio-visual aids are beginning to attain their proper position as primary, basic, teaching materials"

be in proper relation to those for other teaching materials.

3. Annual budgetary allowances should provide for:
   a. An adequate staff
   b. Purchase of materials
   c. Purchase of equipment
   d. Maintenance of equipment and materials
   e. Planned program of equipping existing buildings

   One per cent of the annual per pupil cost is suggested as a minimum operating figure for the audio-visual program. In working out the allowance for "e" above the necessity for initial large appropriations should be recognized. Allowances may be expected to decrease as the program for equipping existing buildings is completed.

Relations Between Distributing Units

The distribution of audio-visual materials still remains in a state of veritable chaos. The relations and interrelations of various distributing units are still characterized by jealousy and distrust despite some attempts to eliminate this mutual antagonism.

The recommendations offered by the Council in this

"The distribution of audio-visual materials still remains in a state of veritable chaos"

connection may be best presented in brief form through the accompanying diagram.

The classroom forms the apex of the diagram. Materials must fit the *need* found here. The school as the next larger unit, is the agency which channels all materials to the classroom. This is done by the building director or coördinator. Throughout its statement the Council recommends the permanent acquisition of basic materials wherever possible. Thus, in a large school, the request from the classroom, particularly in the case of the simpler, less expensive aids, may be filled from material in the school's own audio-visual unit. The local school system forms the next larger unit. To it come all requests from the individual schools. And from it to the larger units go requests for materials which it cannot supply. The relation of local, regional and state distribution units are described in the recommendations as follows:

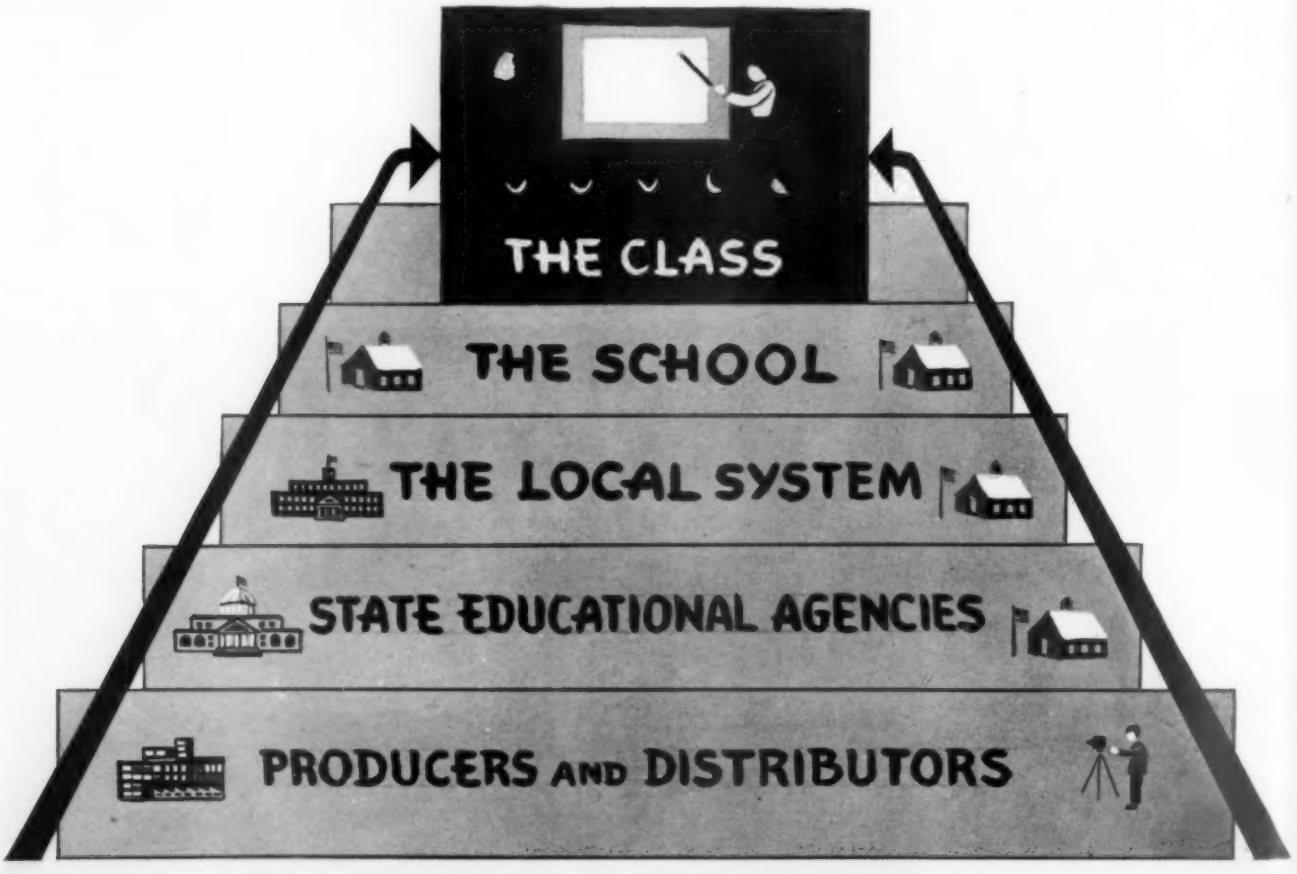
The service unit for the town, city, or county system should provide basic materials for which demand in the individual school is not large enough to support purchase, but for which a general demand and curricular need exist. In addition these depositories should maintain collections of the basic aids found in building service units in order to take care of "overflow" requests and requests from buildings not possessing these audio-visual aids.

Audio-visual services maintained by the state departments of education and/or teachers colleges, and/or university extension services should serve the schools primarily with peripheral materials for which regional or state demand would be great enough to support purchase whereas local demand would not. (Materials which are "basic" for a large city unit may fall in the "peripheral" group for the smaller city or county. Therefore, in the case of motion pictures, for example, such services would need to provide a limited number of prints of almost all generally used educational films. Their most important function, however, would be to supply the specialized or more rarely used materials.)

There is no need for a battle to the death between the various types of distributing units. The provision of audio-visual materials needed for classroom teaching may soon be expected to tax the facilities of all types of service units. A proper understanding of the functions and relations of the various units should result not only in a cessation of hostilities but, with the directing of energies to the one important goal of supplying the classroom with its needs, in expanded programs for all services which supply audio-visual materials.

Other Recommendations

Specific recommendations of importance are also made on teacher training (both pre-professional and in-service), selection of materials, acquisition of materials, organization of the audio-visual unit, preparation of catalogs and teachers guides, delivery services, booking procedures, etc. In many instances a complete manual might well be devoted to the individual recommendations. However, we hope that the recommendations in their present concise, but rather specific, form will provide a frame of reference which will prove of value not only to those who are initiating audio-visual programs, but also to those who are re-examining their present programs prior to postwar expansion.



Channeling of audio-visual materials as outlined by the American Council on Education

SURPLUS PROPERTIES AND EDUCATION

By J. HAROLD GOLDTHORPE

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THE total volume of surplus properties available for distribution at the close of the war has been variously estimated at amounts between twenty-five and one hundred billion dollars. A serious problem which confronts government in dealing with these materials is to provide an effective and orderly method of disposal in such a manner as to interfere least with industrial production, prices, full employment, and at the same time avoid waste of taxpayers' funds.

The volume of surplus property will include almost every conceivable article, and those which will probably be available are estimated to exceed 200,000 separate items. They include capital goods, industrial plants, buildings and facilities, bulldozers, automobiles, tractors, trucks, electrical supplies, food items of all sorts, plumbing and heating equipment, fire extinguishers, furniture, cots, sheets, and blankets. Among the available types of educational equipment and supplies are textbooks, library books, audio-visual equipment, charts and films, health and physical education equipment and supplies, microscopes, surgical instruments, medical, dental, and hospital supplies and equipment, musical instruments, surveying equipment, machine tools, and a vast array of office equipment and furniture, such as typewriters, desks, files, sorting and tabulating machines, and calculators.

Estimates of Consumer Goods

The Surplus Property Board reported in January 1945 that surplus declarations by owning agencies already had amounted to approximately two and one-half billions of dollars. The largest single item was "aircraft and related equipment" and included approximately 25,000 obsolete aircraft inventoried at almost $900 million. The Board estimated that about two-thirds of this amount would have little or no commercial value and probably would be scrapped when manpower permitted. Recent estimates by Board officers relative to the volume of surplus properties in the consumer goods category, the surplus group from which educational institutions will be able to meet most of their needs, indicate that the approximate volume will be considerably smaller than originally thought and will probably amount to between five and ten billions of dollars.

A particularly significant aspect of the Board's report was the high proportion of its property disposals returned to war production which it estimated at approximately 80 per cent. The bulk of these disposals up to this time have been transfers between the War and Navy Departments and terminations on war contracts. It is generally believed that, following the close of hostilities in the European theater of operations, there will be a great increase in surplus declarations, and many of these properties probably will be in the Eastern coastal areas of this country.

Surplus Property Act of 1944

As defined by the Surplus Property Act of 1944, surplus property is "any property which has been determined to be surplus to the needs and responsibilities of the owning agency." And, as further defined, the term "Government agency" refers to "any executive department, board, bureau, commission, or other agency in the executive branch of the Federal Government," together with the wholly owned government corporations. The exceptions to this definition, as stated in the law, are "the public domain, or such lands withdrawn or reserved from the public domain," and "naval vessels of the following categories: Battleships, cruisers, aircraft carriers, destroyers, and submarines."

Under the Act, the Surplus Property Board is charged with the general direction and supervision over "(1) the care and handling and disposition of surplus property, and (2) the transfer of surplus property between Government agencies." The broad grant of powers delegated to this Board is indicated by the following quotation from Section 9(b) of the Act: "Regulations issued pursuant to subsection (a) may, except as otherwise provided in this Act, contain provisions prescribing the extent to which, . . . the prices at which, and the terms and conditions under which, surplus property may be disposed of, and the extent to which and the conditions under which surplus property shall be subject to care and handling." As a guide to the Board in the formulation of its disposal policies, Congress listed some twenty objectives of the Act among which the following are of particular interest to education: (1) "to foster the wide distribution of surplus commodities to consumers at fair prices"; (2) "to effect broad and equitable distribution of sur-

plus property"; and (3) "to prevent insofar as possible unusual and excessive profits being made out of surplus property."

Disposal to States, Local Governments, and Nonprofit Institutions

The pertinent sections of the Act outlining the legal provisions for the disposal of surplus property to the States, local governments, and nonprofit institutions are as follows: (Italics are the author's.)

"Sec. 13(a) The Board shall prescribe regulations for the disposition of surplus property to States and their political subdivisions and instrumentalities, and to tax-supported and nonprofit institutions, and *shall determine on the basis of need what transfers shall be made.* In formulating such regulations the Board shall be guided by the objectives of this Act and shall give effect to the following policies to the extent feasible and in the public interest:

"(1) (A) Surplus property that is appropriate for school, classroom, or other educational use *may be sold or leased to the States and their political subdivisions and instrumentalities, and tax-supported educational institutions, and to other nonprofit educational institutions* which have been held exempt from taxation under section 101 (6) of the Internal Revenue Code.

"(B) Surplus medical supplies, equipment, and property suitable for use in the protection of public health, including research, may be sold or leased to the States and their political subdivisions and instrumentalities, and to tax-supported medical institutions, and to hospitals or other similar institutions not operated for profit which have been held exempt from taxation under section 101 (6) of the Internal Revenue Code.

"(C) In fixing the sale or lease value of property to be disposed of under subparagraph (A) and subparagraph (B) of this paragraph, the Board *shall take into consideration any benefit which has accrued or may accrue to the United States* from the use of such property by any such State, political subdivision, instrumentality, or institution.

"(2) *Surplus property shall be disposed of so as to afford public and governmental institutions, nonprofit or tax-supported educational institutions,* charitable and eleemosynary institutions, nonprofit or tax-supported hospitals and similar institutions, States, their political subdivisions and instrumentalities, and volunteer fire companies, *an opportunity to fulfill, in the public interest, their legitimate needs.*

"(b) Under regulations prescribed by the Board, whenever the Government agency authorized to dispose of any property finds that it has no commercial value or that the cost of its care and handling and disposition would exceed the estimated proceeds, the agency may donate such property to any agency or institution supported by the Federal Government or any State or local government, or to any nonprofit educational or charitable organization, or, if that is not feasible, shall destroy or otherwise dispose of such property, but, except in the case of property the immediate destruction of which is necessary or desirable either because of the nature of the property or because of the expense or difficulty of its care and handling, no property shall be destroyed until thirty days after public notice of the proposed destruction thereof has been given (and a copy of such notice given to the Board at the beginning of such thirty-day period) and an attempt has been made within such thirty days to dispose of such property otherwise than by destruction.

* * *

"(f) The disposal of surplus property under this section to States and political subdivisions and instrumentalities thereof shall be given priority over all other disposals of property provided for in this Act except transfers under section 12."

Present Disposal Organization and Activities

Since the appointments of the three members to the Surplus Property Board have been confirmed only recently, it does not appear likely that the disposal procedures of the new Board will involve immediate and drastic modifications in the policies and procedures adopted by the previous Surplus War Property Administration except insofar as they are mandated by the Surplus Property Act. In the first six months under this Administration, approximately $135 million of surplus properties have been sold. By action of the Administration and continuance by the new Surplus Property Board the following types of surplus properties and the respective disposal agencies have been designated:

Properties Handled	Federal Agency
Capital and producers' goods	Reconstruction Finance Corporation
Consumers' goods	Department of Commerce, Office of Surplus Property
Foods and other allied properties	War Food Administration
Surplus property abroad	Foreign Economic Administration
Merchant ships and small powered water craft and maritime items	U. S. Maritime Commission
Industrial scrap material and other items resulting termination of contracts	Navy Department
Ditto	War Department
Aid to small business in acquiring surplus property	Smaller War Plants Corporation

For the guidance of purchasing officers in requesting information and ordering surplus properties, the following steps are suggested:

1. Address communications relative to specific surplus items to the appropriate field or regional office of the designated disposal agency.

2. Utilize the commercial terms commonly used in purchasing to describe the types of properties desired.

3. Request disposal agency to provide information as to what surplus properties are available and where and how they may be purchased.

Commerce Department, Disposal Operations

On the basis of experience in recent months, the regional offices of the Office of Surplus Property will do business primarily with buyers in the adjacent states and will handle only such properties as are declared surplus in that area. The exception to this general policy is in the case of surplus items in large supply, or when certain items are declared surplus in a given area in such volume as to exceed the capacity of that area to absorb them. In this case, such items will also be offered for sale by other regional offices.

Although the Commerce' Office of Surplus Property is organized in such a way as to channel many surplus items in commercial volumes through the regular wholesale and retail business units, provisions have been made to permit state and local governmental units, educational institutions, school districts, and hospitals to purchase according to their interests and needs. The Surplus Property Office has adopted a policy which extends to the public and educational groups a 21-day priority similar to that afforded federal agencies, within which to purchase surplus property items before these are made available to regular trade groups. After these two groups, federal agencies and local governmental and institutional groups, have made their purchases, dealers are then given the opportunity to bid upon this surplus merchandise.

How to Get Information on Surplus Properties

In order to keep in touch with available surplus items, superintendents, presidents, and business officers

interested in specific items should contact the regional procurement office in their district and advise the Deputy Director of Sales, Office of Surplus Property, concerning the items in which they are interested. The regional office will then send forms upon which officers may indicate the specific items in which they are interested, and these should be filled out and returned promptly according to directions.

Upon receipt of information concerning the types of items offered for sale, educational purchasing officers should then request copies of informal bid lists for the group of items in which they are interested. Bids for the group and number of items which they wish to purchase should then be entered upon this form and returned promptly. Upon notification of acceptance by the Office of Surplus Property, the school or college can then close the transaction by payment for the merchandise.

Classification Plan of Consumers' Goods

Surplus Property Office has adopted an eightfold classification scheme which is built around the potential buyers of such items as hardware, medical supplies, machinery, paper, and office supplies. Its commodity classification for surplus items, which should be used in indicating to regional offices the types of items which are to be purchased, follows:

1. *Furniture*—hospital, household, laboratory, and office furniture, floor coverings, mattresses, bedsprings, and pillows.
2. *Machinery* — construction equipment, tractors, trailers, agricultural and miscellaneous machinery.
3. *General Products*—batteries, containers, electrical supplies, lighting equipment, photographic equipment, and livestock.
4. *Automotive*—trucks, tires, automobiles, generators, and related equipment.
5. *Hardware*—plumbing and heating equipment, sporting goods, hand tools, rubber goods, houseware, and musical instruments.
6. *Textiles and Wearing Apparel*—fabricated textiles, footwear, leather goods, and wearing apparel.
7. *Medical and Surgical*—drugs and medicines, dental equipment, thermometers, rubber goods, hospital equipment and supplies, optical, laboratory, and surgical equipment and instruments.
8. *Paper and Office Supplies*—paper, office equipment and supplies, and stationery.

Educational institutions whose needs for surplus properties are extensive and varied will find the revised *Buyer's Guide for Surplus Properties* extremely helpful. Although this guide does not list specific available properties, it contains detailed instructions to locate specific types of properties, disposal agencies, and addresses of offices. This booklet, which costs 10 cents per copy, may be secured from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

U. S. Office of Education Committee Report

Following the suggestion of William L. Clayton, former Surplus War Property Administrator, the Commissioner of Education appointed an Advisory Committee to study and formulate recommendations relative to policies concerned with surplus properties and schools and colleges. This committee of 17 members includes representatives of all educational levels, of publicly controlled and privately controlled schools and colleges, and of several national educational associations. The committee has held several meetings and through a small working subcommittee and the chairman, Henry F. Alves, of the Office of Education, has worked closely with the officers and members of the former Surplus War Property Administration and the newly organized Surplus Property Board.

Scope of Deliberations

Recently the Commissioner of Education submitted the reports of the Advisory Committee to the Surplus Property Board. These reports dealt primarily with the following items: (1) the need on the part of educational institutions for surplus properties, (2) public benefits which will accrue from the use of such properties, (3) the postwar obligations of education, (4) the urgent need of improved public library services in rural areas, and (5) recommendations on price policies.

Formation of Overall State Educational Agency Recommended

In order to deal effectively with the large number of educational groups and their varying needs for surplus properties, it is clear that an additional organization is necessary within the states. With but few exceptions, the states have a considerable number of boards and commissions in charge of their educational institutions, and each privately controlled institution is generally under a separate board of trustees. There are approximately 118,000 local public school districts or administrative units ranging in size from small one-teacher districts to large counties and cities. There are also approximately 600 publicly controlled and more than 1,100 privately controlled institutions of higher education. Moreover, there are, in addition, several thousand non-public elementary and secondary schools.

To plan for the prompt and effective utilization of surplus properties by educational institutions, the decentralized control structure of the schools and colleges must be taken into account. It would be extremely difficult, inefficient, and undesirable for a federal agency to deal directly and separately with each of the bodies in charge of the educational programs. After considerable study of this problem, the Advisory Committee recommended to the Surplus Property Board that each state establish an "over-all" state educational agency to represent all educational institutions—publicly controlled and privately controlled nonprofit schools and colleges—in their relations to the Surplus Property Board and disposal agencies. The committee recommended that such a body be responsible for the development of policies within the states and for the following functions and services:

1. Utilizing to the maximum extent existing educational boards and authorities at the state and local levels.
2. Establishing criteria, in keeping with prescribed regulations and with a program of effective utilization of the property involved, to be used:
   a. By existing educational boards and authorities in determining estimates of need; and

b. For approving applications (requisitions) from eligible educational institutions for available surplus property.

3. Collecting and reviewing, for validity and quantity, the estimates of need in conformity to established criteria.

4. Preparing, certifying, and transmitting necessary summaries of estimates of need.

5. Transmitting approved requisitions to the appropriate authority.

6. Making allocations as necessary in case of short supply of designated items of surplus property.

7. Transmitting to existing educational boards and authorities (by whatever names called) information re:

a. Availability of kinds and types and locations of designated surplus properties; and

b. Rules and regulations of the Surplus Property Board and designated disposal agencies with respect to the program of disposal.

The committee further recommended that the Board adopt a general policy of "nominal pricing" with respect to the distribution of surplus properties to educational institutions. It defined nominal pricing as representing "the necessary cost of packing and handling, excluding the cost of transportation . . . from reasonably accessible points of disposal." It further indicated that the policy of nominal pricing "will affect to the greatest degree 'a broad and equitable distribution of such property' with the consequent public benefits and that it would provide to the largest number of educational institutions 'an opportunity to fulfill, in the public interest, their legitimate needs.'"

The Office of Education has indicated its plans to publish in the near future a digest of the reports submitted to the Surplus Property Board. It is expected that this will be accomplished by publication in the Office's regular magazines, *Education for Victory* and *Higher Education*.

Up to this time the Surplus Property Board has been concerned primarily with the development of its internal organization and the improvement of its relationships with the disposal agencies. It is expected that in the near future it will issue its regulations dealing with the access priorities for educational and health agencies and institutions. It is not yet clear when the Board will take action with respect to its price policies.

Making Ready for Participation

Although the preparation of regulations by the Surplus Property Board to assist educational agencies to avail themselves of their rights and opportunities under the Surplus Property Act is a lengthy process, administrators of schools and colleges have important responsibilities in order to participate in the disposal program. They should list their current and future needs in both instructional and plant maintenance supplies and equipment. These needs should be assembled and available for whatever state organization is created to summarize the surplus property needs of educational agencies and for the designated disposal agencies.

Educational administrators should cooperate with their business and purchasing officers to familiarize the regional and disposal agency officers with their surplus property needs. They should list their needs with these officers rather than ask what the disposal officers have to sell. Lists of available surpluses change constantly and are in such a huge volume as to render it impossible to compile, revise, and circulate such lists to all potential purchasers.

List of Regional Procurement Division Offices and Addresses

Region and States		Deputy Director of Sales, Office of Surplus Property, Department of Commerce
Region 1:	Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont	Park Square Building Boston 16, Massachusetts
Region 2:	New Jersey New York Pennsylvania	Empire State Building 350 Fifth Avenue New York 1, New York
Region 3:	District of Columbia Delaware Maryland North Carolina Virginia	1126 21st St., N.W. Washington 25, D. C.
Region 4:	Indiana Kentucky Ohio West Virginia	Commercial Arts Building 704 Race Street Cincinnati 2, Ohio
Region 5:	Illinois Michigan Minnesota North Dakota South Dakota Wisconsin	Room 300 209 South La Salle Street Chicago 4, Illinois
Region 6:	Alabama Florida Georgia Mississippi South Carolina Tennessee	Belle Isle Building 20 Houston Street, N. E. Atlanta 3, Georgia
Region 7:	Arkansas Louisiana Oklahoma Texas	609 Neil P. Anderson Building Fort Worth 2, Texas
Region 8:	Iowa Kansas Missouri Nebraska	2605 Walnut Street Kansas City 2, Missouri
Region 9:	Colorado New Mexico Utah Wyoming	Room 708, Exchange Building 1030 Fifteenth Street Denver 2, Colorado
Region 10:	Arizona California Nevada	30 Van Ness Avenue San Francisco 2, California
Region 11:	Idaho Oregon Montana Washington	200 Fifth Avenue Seattle 1, Washington

Right—Fluorescent lighting in this room at the Caledonia School, East Cleveland, Ohio, provides 50 foot-candles of daylight quality lighting all over the room. There is no place on either the lighting unit or ceiling that is brighter than the work. Notice, also, the germicidal lamps mounted over the blackboard

Below — Note that the windows here extend up to the ceiling to admit high-level natural light. For rainy days, or when shades are drawn, comfortable, artificial lighting is obtained from incandescent filament lamps with photo-cell control (see photo-cell mounted on the wall)

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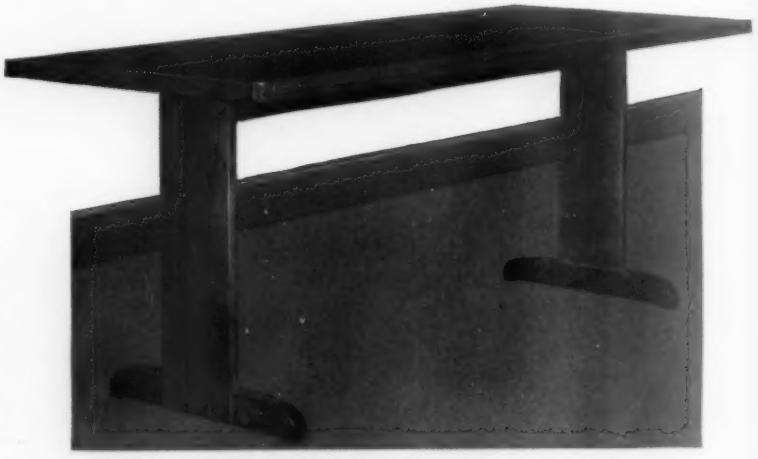

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University type chair of graceful design and soft-toned coloring that harmonizes with any architectural style. Solidly constructed for generations of severest use and minimum maintenance. Deep curved, comfortable back is of ¾ inch 7 ply selected birch face plywood, casein glued with rounded edges. Solid maple seat with universal saddle form. Seat height 17". Tablet arm, 12 x 23½"

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C	I-III	11½-15½"	23-28"	28⅝"	9 and 10"	10½"
B	II-VI	11½-15½"	23-28"	29⅝"	10 and 11"	12¼"
A[3]	V-Adult	14 -18"	26-31"	30⅝"	11 and 12½"	14"

1. Seat swiveling requires 3-inch additional floor space.
2. Both spacings provided for in seat construction.
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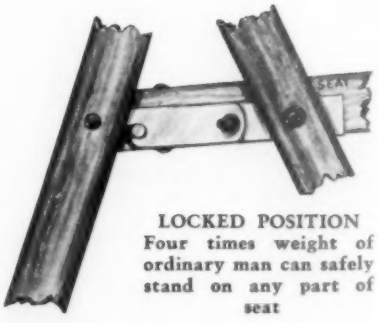

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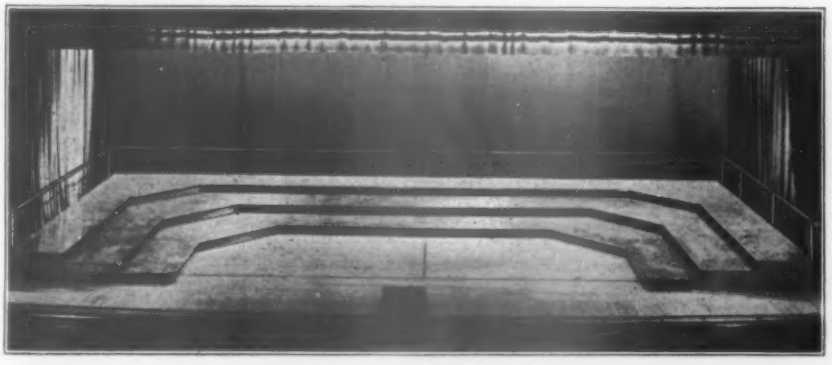

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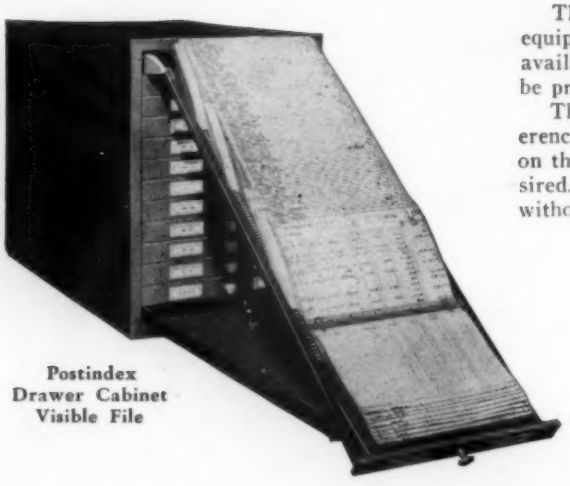

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The Postindex Drawer Cabinets are generally accepted as standard equipment for many school record requirements. Standard cabinets are available in a large variety of card sizes. Any size and any capacity may be provided for in the Postindex line of Drawer Cabinets.

This line of Postindex equipment is especially convenient for quick reference purposes since the proper drawer may be quickly located by the index on the front, and as quickly extended for finding of the card or record desired. Postindex is also fastest for posting purposes as posting is done without taking the form out of the file.

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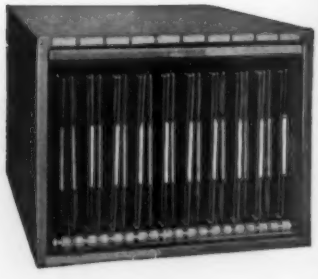

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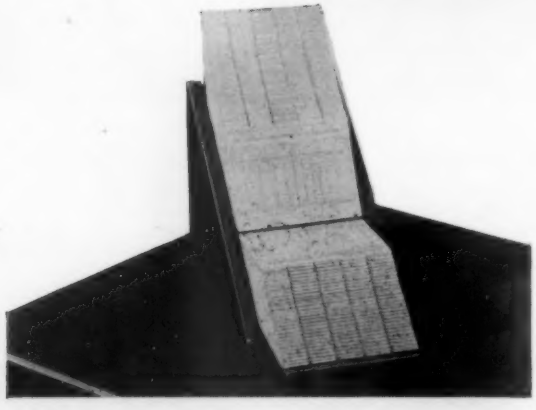
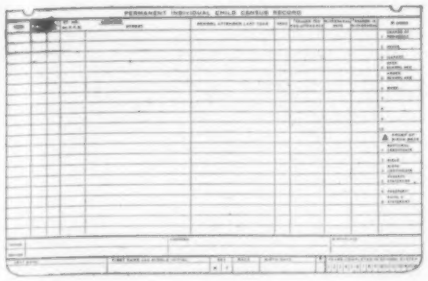


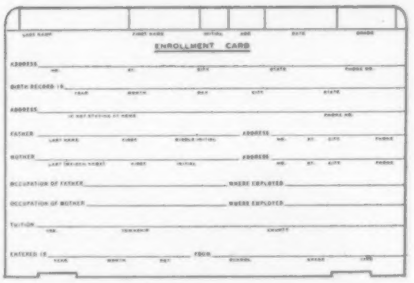
VERTICAL STUDENT ROSTER

This unit is designed to permit immediate transfer of student records from present blind files to visible file with up to 375 names in sight at one time. The record forms are simply placed in the slotted index cards and name labels inserted under celluloid tabs. The unit illustrated is WV-Z8575-C for 8 x 5 forms and is completely assembled ready to use with a supply of index labels.



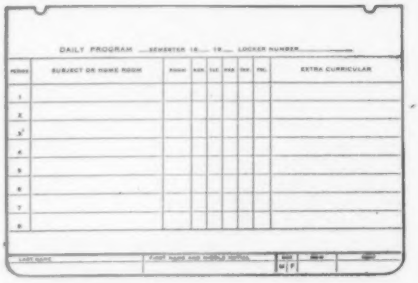
Individual School Census Card

Postindex form 81-C-6385-8. This shows one side of a two-page card which incorporates complete census information and attendance information. The back side of this card shows history of employment



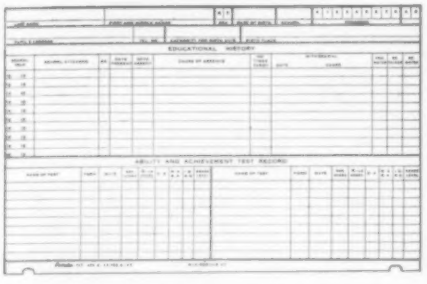
School Enrollment Card

Postindex form 81-B-2916-8P. This is a two-page form with illustration showing the enrollment record. The back side of this same card covers daily program record



Individual Child's Daily Program

Postindex form 81-B-2913-8. This is a four-page form with illustration showing the daily program for a student. The other pages are devoted to registration information and attendance

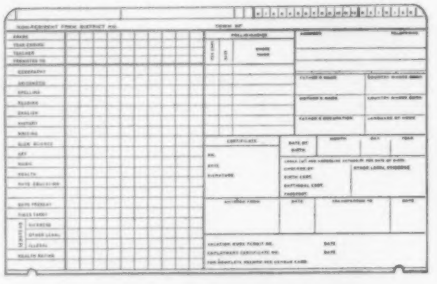


Individual Pupil Cumulative Record

Postindex form 81-C-06072-8CT. This illustration shows one page of a four-page form covering educational history, ability and achievement test record. The other three pages provide for scholarship record and health information

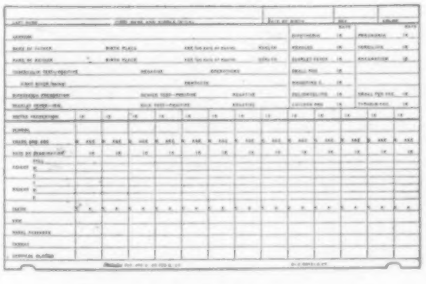
Secondary School Cumulative Record

Postindex form 81-C-05971-8CT. This illustration shows one page of a four-page form with academic record and attendance information. The other three pages provide for general information, extra curricular activities, achievements, with space for intelligence and achievement tests



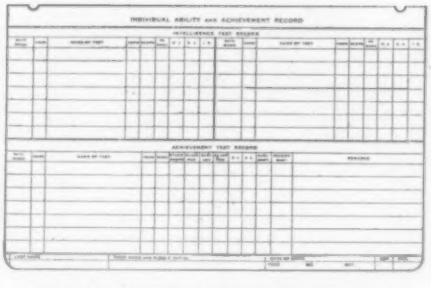
School Cumulative Record

Postindex form C-4077-P. This is a four-page form with illustration showing the elementary scholastic record. One of the other pages covers scholastic record for Junior and Senior High School while the other two pages provide space for recording pupil activities, guidance facts, intelligence and achievement tests



Individual Health Record

Postindex form 81-C-06121-8CT. This is a four-page record with illustration showing a portion of health history. The other three pages are devoted to a continuation of the same record

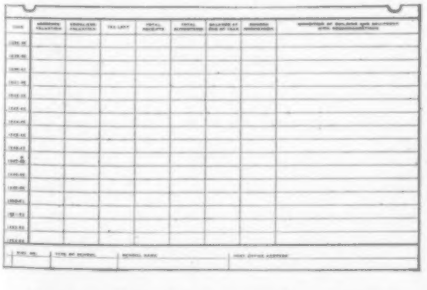


Individual Achievement Record

Postindex form 81-C-6387-8. The illustration shows front side covering intelligence tests and achievement tests. The back side is a continuation of achievement tests

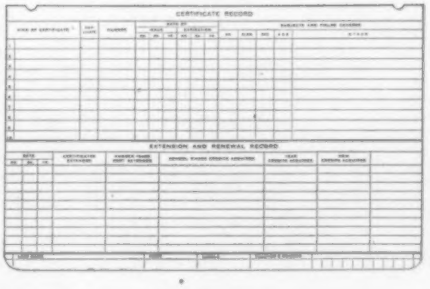
Teacher's Card

Postindex form 81-C-06112-8CT. This is a four-page record with illustration showing teacher's experience. The other three pages are devoted to personal information, educational background, special training and certification, health and general remarks



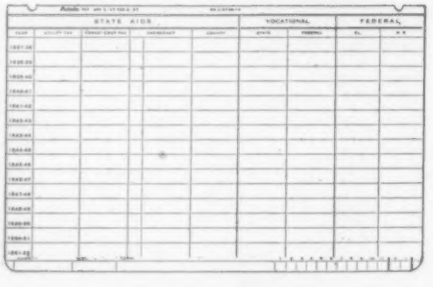
County Financial Accounting Record

Postindex form 81-C-06111-14CT. This is a four-page form with illustration showing financial record. Other pages are devoted to census, enrollment, attendance and information about board members, also State and County financial support



Florida Form

Postindex form 81-C-6370-8. This is a four-page form with illustration showing the teacher's certification, extension and renewal record. The other three pages are devoted to experience, training and general information



Wisconsin Form

Postindex form 96-C-5740-14. This is a four-page form with illustration showing State Aid data. The other three pages provide record in regard to statistical information, census, enrollment and teachers

ART METAL for the ADMINISTRATIVE OFFICE

The Art Metal Construction Company, Inc., offers a functional application of its products and services to modern school building situations. The scope of its furniture—from the most modern desks, tables, bookcases, safes and visible files for the administrative office to special equipment for the library, corridor, laboratory, shop lecture rooms and storeroom—is an illustration of its wide interests and services.

VERTICAL FILES

Art Metal Files for every standard record in units from desk-high to five-drawer sizes. These highest grade files have lifetime ball-bearing roller suspensions and a new, improved side-lock compressor

ART METAL AIRLINE DESKS

Art Metal's new desk creation is the Airline which has gracefully rounded Island Bases under each pedestal and black artolin top with white satin finish hardware

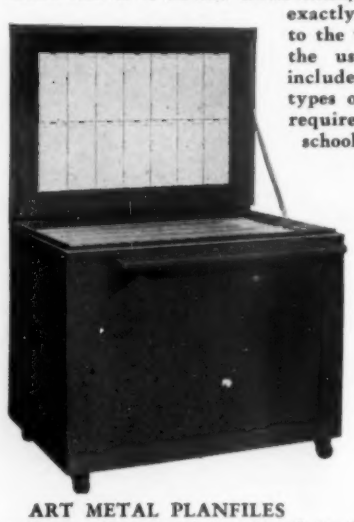
Airline desks may also be equipped with the new Art Metal Fold-O-Way typewriter device and as in all Art Metal desks, may be exactly fitted to the work of the user and includes all types of desks required in the school office

STORAGE CABINETS

Art Metal Storage Cabinets for all storage purposes come in single and double door widths, also in desk heights and may be had with wardrobe fittings

FIRE SAFES

Art Metal Fire Safes, available in twenty styles and sizes, preserve valuable records against fire or theft. Tested and approved by the Underwriters' Laboratories



ART METAL PLANFILES

The exclusive feature of Art Metal Steel Planfiles consists of compression pockets which hold drawings, tracings, blueprints, in folders—upright, flat and perfectly smooth

BOOKSHELF UNITS

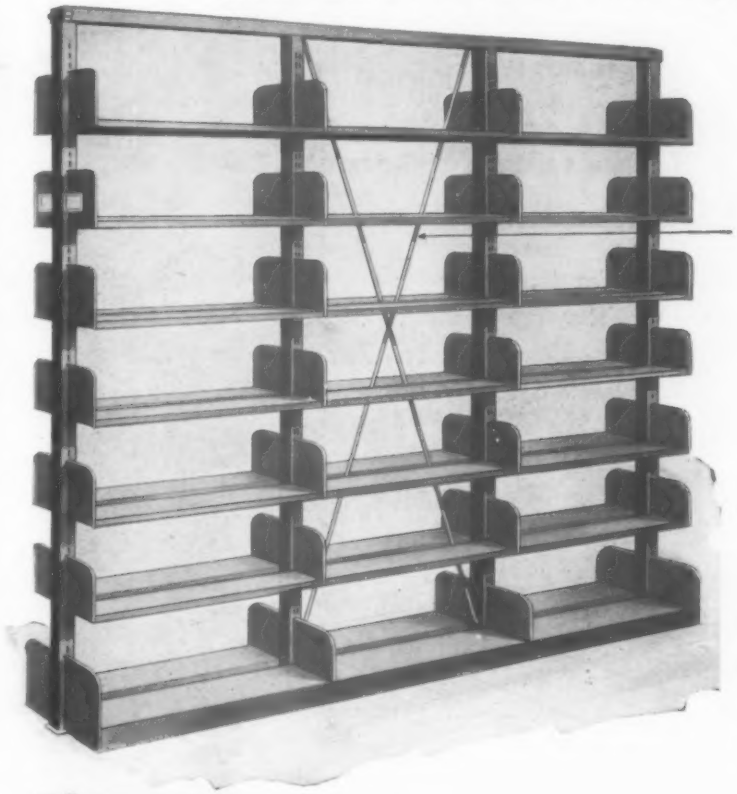
This is the famous Space-A-Shelf unit using the Art Metal library shelf adjustment principle. Detachable end panels are used to save space in batteries of units —especially suitable for schools

Art Metal flag, trophy and museum cases are of patented dust-tight construction and may be had in table type or free standing cabinets with or without shelves and with glass solid backs for the display of exhibits as required by schools

MUSEUM CASES

Shown at the left is a recessed wall case about 12 feet long and equipped with semi-indirect lighting which emanates from behind the central pilaster. This case has sliding doors. Cases can also be furnished with doors hinged at the top or side, also with removable panels. A case of this kind is particularly advantageous for displaying educational exhibits

ART METAL FOR THE SCHOOL LIBRARY



ART METAL "UNITYPE" BOOKSTACKS

The types of UNITYPE Bookstacks are offered (as shown on this page): Free-Standing Stacks and Top-Braced Units, both models single or double-faced. Booklet free on request.

The TOP-BRACED bookstack is recommended for locations where it is undesirable to use floor fastenings. Top bracing makes floor fastening unnecessary.

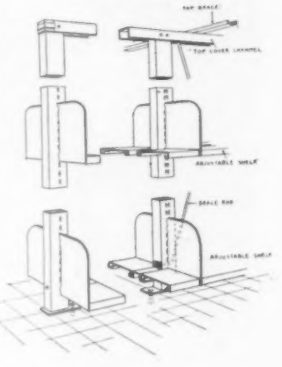
ART METAL EQUIPMENT FOR LIBRARIES INCLUDE

- Standard Type Book Stacks
- Bracket Type Book Stacks
- Bracket Type Rolling Book Stack
- Charging Desks
- Vertical Files
- Stairs and Railings
- Booklifts
- Card Catalog Files
- Reading Tables
- Magazine Racks
- Book Trucks

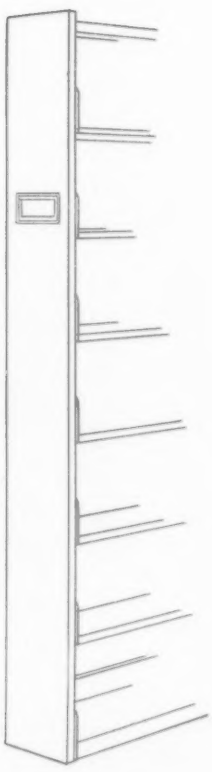
FREE-STANDING UNIT —DOUBLE-FACED

Each double-faced section contains 2 closed base shelves 10″ deep, center dimensions; 12 shelves adjustable 1″ on centers 8″ deep, center dimensions; stack 90″ high overall. Each unit must be securely fastened to floor

CONSTRUCTION DETAILS

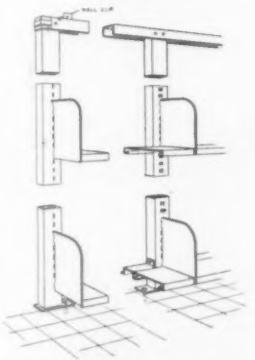


FREE-STANDING UNIT—SINGLE-FACED
Each single-faced section contains 7 shelves adjustable 1″ on centers, stack 90″ high o.a., 8″ deep, center dimension. Fasten securely to floor



TOP-BRACED STACK— DOUBLE-FACED

Each double-faced section contains 14 shelves adjustable 1″ on centers; stack 90″ high o.a., 8″ deep, center dimension



TOP-BRACED UNIT— SINGLE-FACED

Each single-faced section contains 7 shelves adjustable 1″ on centers; stack 90″ high o.a., 8″ deep, center dimensions

THE GLOBE-WERNICKE CO.

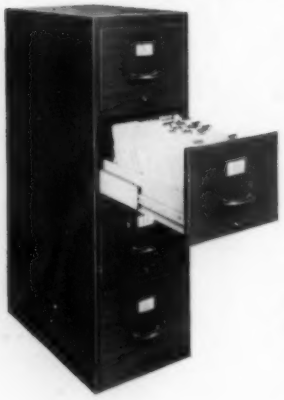
Norwood 12 — Cincinnati, Ohio

"Headquarters for Modern Office Engineering"

SHOWN here are a few of the thousands of office aids that Globe-Wernicke has designed and produced to help speed up and simplify work in schools and libraries. These products have been developed to meet a wide variety of specific needs. They are efficient, well built, and long lasting. For special assistance with equipment problems, consult your Globe-Wernicke dealer, or write direct to us.

★ ★ ★

DEFENDER WOOD FILES



Smooth operating, good looking, made only of quality materials, these files have an exclusive drawer suspension for feather-touch control regardless of load. Not just a wartime substitute, but built for years of beauty and service. Available in 2-, 3-, and 4-drawer styles, letter and legal sizes. Drawers can be fitted with inserts for cards, checks, or documents. Finished in rich imitation walnut, or green.

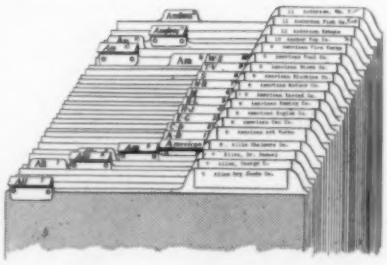
HORIZONTAL WOOD SECTIONS

Easy intermembering and flexibility make these sections the answer to countless filing problems. Available in a wide selection of units for office and library. Select a tailor-made group to fit your needs today; it can be expanded to meet later requirements. All sections are made of quality wood, and may be had in green or imitation walnut finish.

When steel is available the Globe-Wernicke Co. will again furnish their well-known lines of Steel Files and Horizontal Sections

SAFEGUARD FILING SYSTEM

So completely simple and practical that the newest clerk can file papers accurately, find them quickly; so adaptable that it can be expanded from a single drawer to a hundred cabinets without major change.



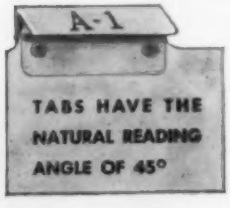
FREE! Write for your copy of "Find-i-tis," the new booklet that makes *any* filing system work better.

VISIBLE RECORD EQUIPMENT

Gives You the "Whole Picture" at a Glance

Actual time studies show that Globe-Wernicke Visible Record Equipment can save up to 33¼ minutes out of every hour spent in finding and refiling card records. You pull out a tray and the cards are visible for swift identification; flip up the one you want—it stays put so you have both hands free to jot down notes or make entries. Cards are easily removed and replaced, yet can't come loose till you release them.

ANGULAR CELLULOID TAB GUIDES

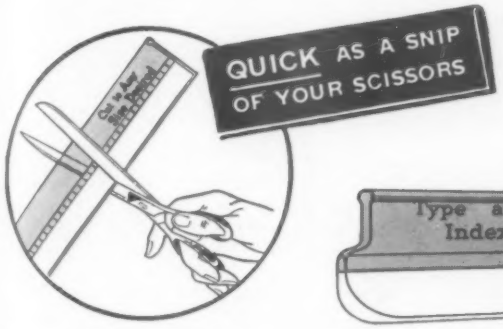


They look you in the eye—make filing and finding quicker and easier. No metal to obstruct view of the tab. Long-lasting because tab *gives with the guide.* Exclusive construction carries pressboard shoulder to top of tab for extra strength. Rounded corners on guides prevent dog's-ears.

ALL TYPES OF STOCK AND SPECIAL FORMS AVAILABLE

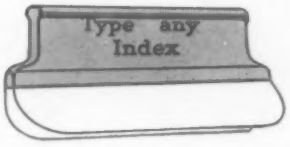
Wide application of Globe-Wernicke Visible Records has enabled us to collect a tremendous variety of stock forms. To meet special needs, our Records Engineers will be glad to design and supply you with special forms.

"U-MAK-A" INDEX TABS . . . Put Facts at Your Finger Tips!

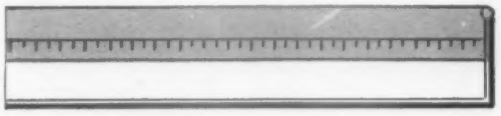


Key your catalogs, directories, text books . . . quickly, easily, inexpensively. Attractive selection of bright colors.

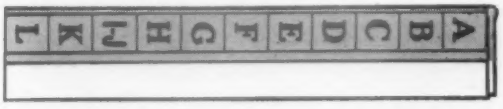
Made of heavy celluloid with cloth skirt. The beaded edges give an easier grip, and greater strength.



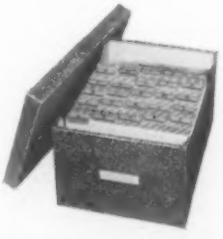
Shield Type is ready-made in four handy sizes—⅝", 1", 1½", and 2"—all with ⅜" tab projection.



Strip Type has built-in measuring scale for quick accurate cutting.



Indexed Type has letters printed directly on the celluloid; two sizes: ¼" x ¼" and ⅜" x ½"; green only.



AGATE CARD INDEX TRAYS

Thrifty and practical, stout construction for long service. Removable lid is dust-proof. Follower block on counter-sunk rod keeps cards upright. All standard card sizes and check size.

BOX FILES

Popular for current letters, bills, and invoices. Students and writers like them for lecture notes, reports, and manuscripts. Indexed A to Z or 1 to 31. Choice of snap or suitcase lock.

EVERY DAY FILES

For sorting papers and organizing work, this patented office aid is now handsomely restyled in rich blue linen-weave fabric printed in silver and black, with high-visibility gray tabs. Wide selection of indexing.

ACCESSO WOOD DESK TRAYS

Wide cut-outs make them handy to reach from all sides, eliminate digging for papers. They may be stacked to any desired number of decks for incoming and outgoing mail and for routing papers to files or to various departments.

GLOBE-WERNICKE'S WORLD-FAMOUS SECTIONAL BOOKCASES

Superb wood, skillfully worked by master craftsmen in designs of classic simplicity has made the Globe-Wernicke Sectional Bookcase an attractive furnishing for home, school, studio, or library. Its functional utility has won world-wide fame. Timeless in pattern and enduring in construction, many have passed the half-century mark in active use. Never too large or too small for your needs. You buy only the sections you require, add more as your library grows. Dustproof glass doors glide silently over the tops of the books. Available in fine natural woods and in imitation walnut or mahogany.

Send for free booklet, "The World's Best Books," a helpful check-list of good reading for adults and children

★ ★ ★

ACME VISIBLE RECORDS, INC

122 South Michigan Avenue

Chicago 3, Illinois

***Acme Visible Equipment,* applicable to every kind of school record, multiplies the value of the record and *in addition* effects a substantial saving in clerical time**

ADVANTAGES

1. Acme VERI-VISIBLE equipment provides visualized control and speed for both machine-posted and hand-posted records. Ask for Booklet No. 519.

2. VISION cabinets, with protected record pockets, provide many ingenious arrangements for multiplying the value of your records. Booklet No. 387.

3. Acme VISIBLE PANELS with Flexoline strips give you the essential facts at a glance. Wall hung, they are admirably adaptable to a variety of school uses. Bulletin No. 417 contains helpful information on use of this type of record.

4. ACME VISIBLE CARD BOOKS are compact, portable, light weight, inexpensive. They will not mar or scratch desks. Ideal for the many important small records. Ask for illustrated price list.

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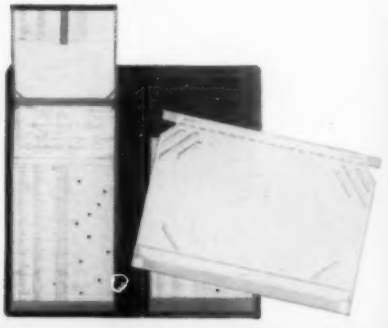
Many types and sizes. We will gladly submit recommendations



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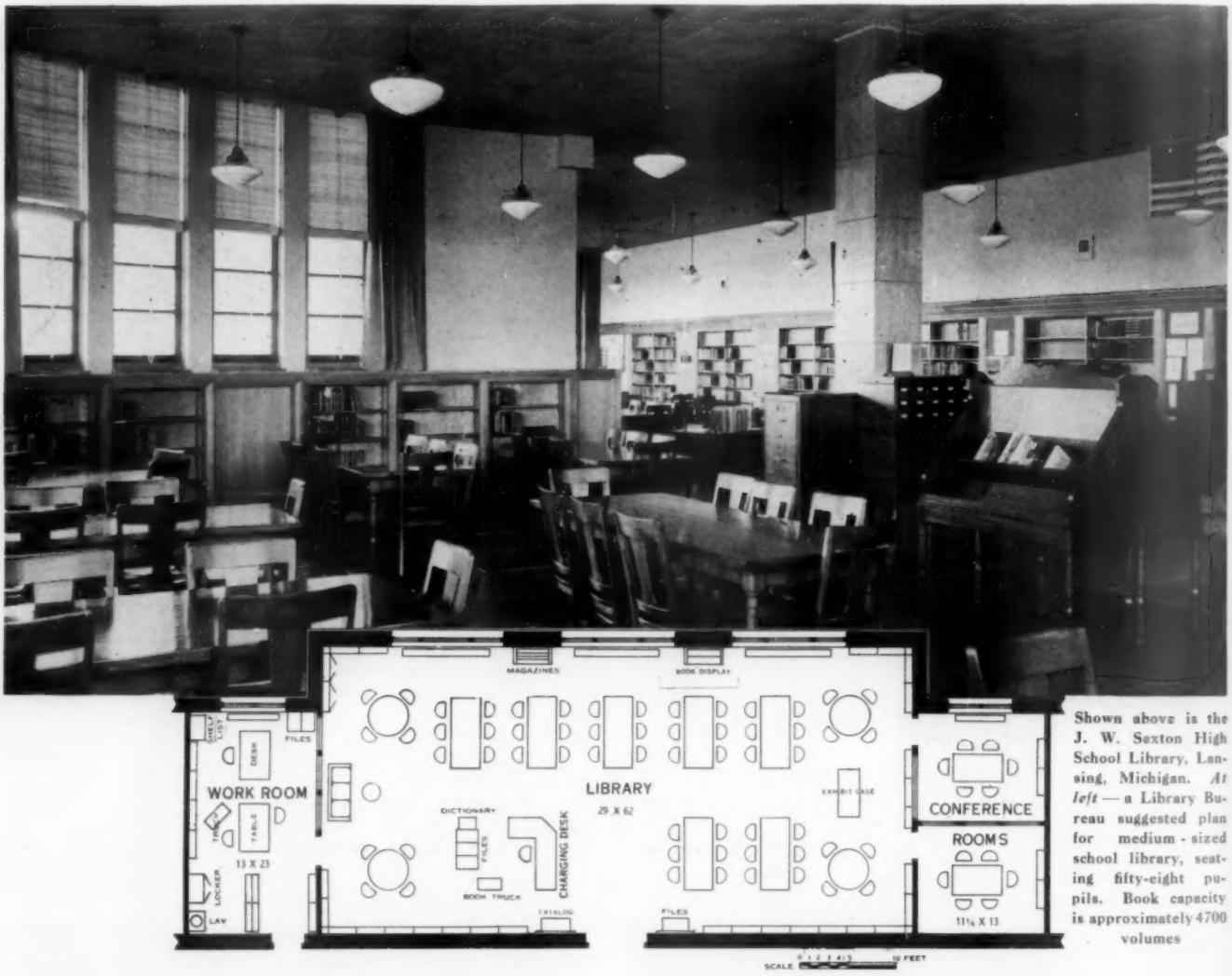
LIBRARY BUREAU HELPS YOU PLAN



Shown above is the J. W. Sexton High School Library, Lansing, Michigan. *At left* — a Library Bureau suggested plan for medium-sized school library, seating fifty-eight pupils. Book capacity is approximately 4700 volumes

LIBRARY BUREAU'S sixty years of skill in producing specialized equipment for school libraries is evidenced by the attractiveness, utility, and completeness of the furniture and operating facilities that are now available to the librarian.

A comprehensive planning service is offered by Library Bureau that assists in blending functional design with the "hearthstone warmth" so important today. The scope of this service extends from the layout of the library itself to the detailed planning of equipment.

Architects and school executives find they receive valuable aid in planning a new library or in expanding the present facilities by consulting Library Bureau. This service is offered without obligation, of course. Simply write to our nearest Branch Office.

"Planning the School Library" is a fully illustrated comprehensive planning manual. Let us send you a free copy

LIBRARY BUREAU DEPARTMENT

REMINGTON RAND INC.

Buffalo 5, New York

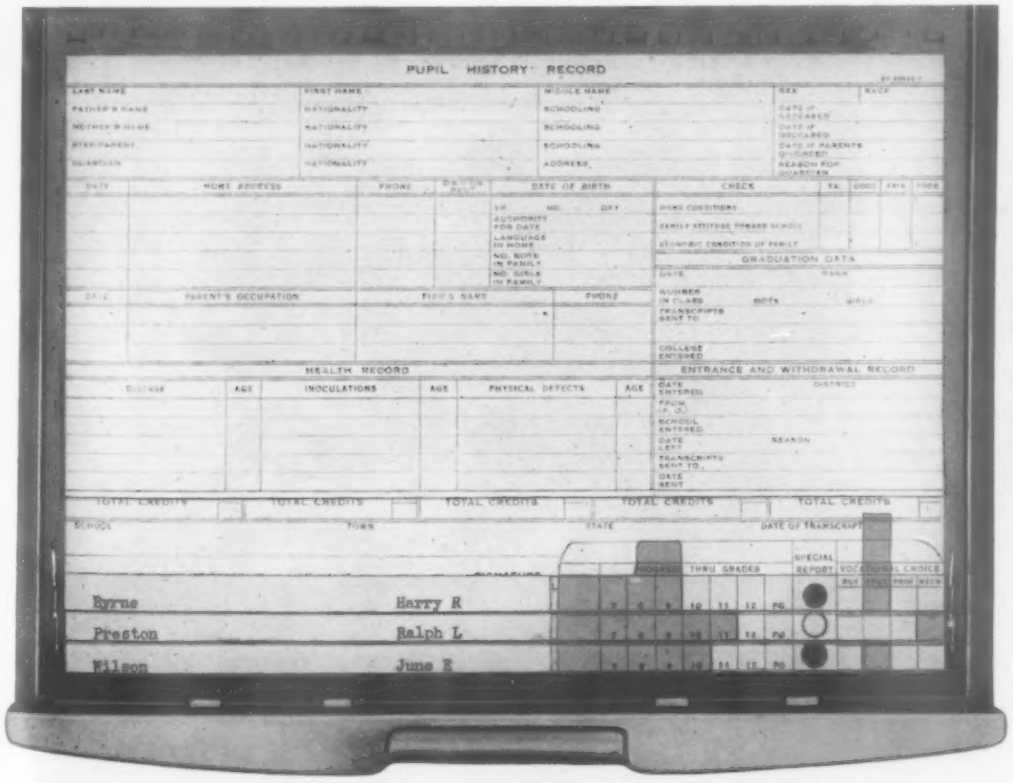
KARDEX SIMPLIFIES ADMINISTRATION

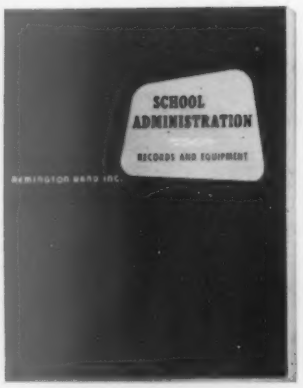
School records in Kardex Visible Systems give school officials instantaneous reference to all pupil, teacher and staff activities—providing an efficient, centralized record control.

Kardex brings facts into view with no loss of time or motion. Colored signals on visible margins reveal vital information at a glance without divulging detailed contents of the card. When entries are to be made or reference to complete data is desired, a flip of the finger brings the entire record into view, with no need for removing the card. Hazards of loss or misfiling are thus eliminated.

The flexibility and simplicity of Kardex are such that individual or unusual record-keeping requirements are easily met. Remington Rand Systems Technicians are prepared to devote special study to administrative needs of schools and colleges, thereby insuring installation of specific record control systems that embody maximum efficiency and economy.

Services of Systems Technicians may be obtained without obligation through our nearest Branch Office.





"School Administration," a 76-page manual fully illustrated, describes methods that will save time and make your reports easy to compile. Send for a copy. *It's free!*

Left — Pupil record of a Junior-Senior High School. Signals disclose progress through grades and vocational choice

A few of the Records for which Kardex is universally effective . . . Pupil History Record . . . Pupil Guidance Record . . . Pupil Health and Physical Education Record . . . Pupil Attendance Record . . . Pupil Program Record . . . Purchase and Stock Record . . . Teacher Placement Record . . . Teacher Substitute Record . . . Budget and Financial Record . . . Textbook Record

SYSTEMS DIVISION

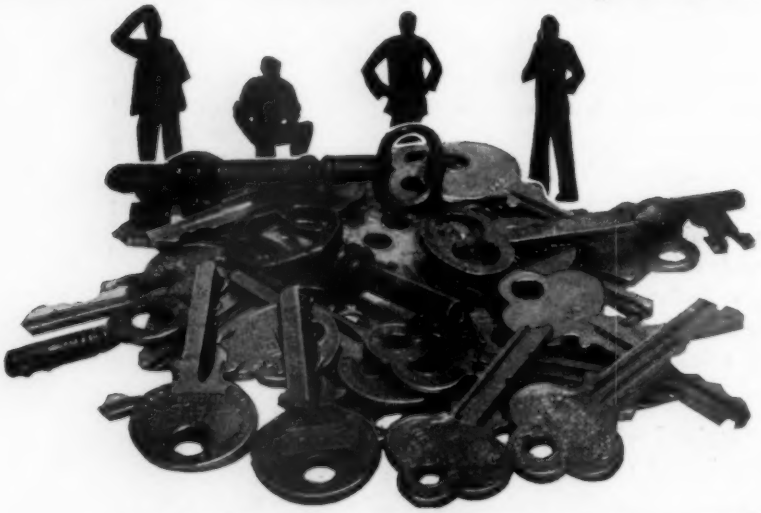
REMINGTON RAND INC.

Buffalo 5, New York

P. O. MOORE, Inc.

300 Fourth Avenue — Telephone — ALgonquin 4-5623 — New York 10, N. Y.

Where? When? *Anytime!*



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It costs money to keep on using a filing system — or having none at all — which does not make available, instantly, any key needed. The time used and the cost of the material necessary to organize your keys is small indeed when compared to the cost of replacements and of time consumed searching for lost or misplaced keys.

WHERE YOU FIND "NO KEY TROUBLE HEADACHES" THERE YOU'LL ALSO FIND TELKEE TRADE MARK

EFFICIENCY

There are no frills or furbelows attached to a TelKee outfit — just a few materials you can easily put in operation to produce a most attractive system for quick accurate filing and finding of keys.

You will find it most satisfactory and economical to use.

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Second and Court, Covington, Ky.

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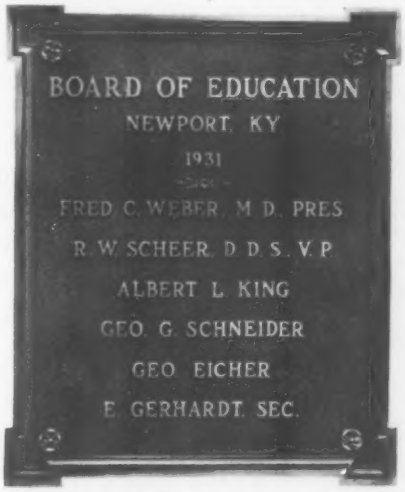
Bronze Tablets and Signs · Bronze Doors and Casement Windows · Name Plates · Office and Lighting Fixtures · Bulletin Boards · Building Directories · Railings · Desk Sets · Lamp Standards Grilles and Wickets · Radiator Grilles · Kick and

PRODUCTS

Push Plates · Push Bars · Time-Tight Exhibit Cases · Cast and Extruded Thresholds · Wire Work (Partitions, etc.) · Marquise, and many other ferrous and non-ferrous metal products.

Michaels Bronze Tablets and Signs are manufactured in a wide variety of designs, shapes and sizes to meet all school and college requirements. A few are illustrated below. Bronze, virtually indestructible, is the ideal metal for permanent memorials. It lends itself readily to the hands of skilled craftsmen and becomes more beautiful as time goes by. Many designs may be furnished from standard patterns or modeled to your specifications. We shall gladly submit sketches and quote prices. When necessary, additional blueprints will be furnished for approval. Just tell us the space, the purpose of the tablet, and the wording to be used. Fully illustrated folder will be sent on request. Until the war is over, Michaels' entire resources will be engaged in the manufacture of war needs. After victory has been won, Michaels will resume the creation and production of Bronze Tablets and Signs, Time-Tight Exhibit Cases, and scores of other peacetime needs. In the meantime, we shall be glad to furnish complete information on any of the products listed above.

Although the installation must be postponed until after the war, it is not too early to plan a lasting memorial in recognition of those who served and sacrificed their lives that our nation might remain free. And what more fitting memorial than a Michaels Art Bronze Tablet? One of many designs is illustrated above.



Bronze Tablets commemorate the construction of buildings or perpetuate the memory of public servants and benefactors who dedicated their lives to the service of mankind. Many designs, plain and ornate, in sizes to meet your requirements, are available for such tablets.

Laurel design with contoured top. Bears intaglio portrait. Tablet size 20″ x 25″

Bronze name plates in any size, with or without title

Michaels *Time-Tight* Exhibit Cases with Innerlocking Frames

Above: **Type 120**

Left: **Type 130**

Michaels Table Cases, Wall Cases, Aisle Cases, Suspended Cases, Recessed Cases, or Special Cases are manufactured with either extruded bronze or aluminum frames, and all have Michaels' exclusive innerlocking feature. Satin finish is standard, but if desired, electroplated or polished finishes may be supplied. Frames take full ¼″ polished plate glass. Shelves of glass, ¼″ or ½″, depending on weight requirements, have all four edges polished. Shelf supports are adjustable every inch. Paracentric locks are standard in all locked cases. No screws are exposed on the face of frames except where necessary for removable or hinged panels. If illumination is necessary, it will be the latest and best type. Illustrated folder giving complete specifications will be sent on request.

DICTAPHONE CORPORATION

420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Speed and Convenience of the Dictaphone Method Aid in School Administration

In hundreds of America's leading schools and universities, the Dictaphone Method is helping hard-pressed administrative staffs keep pace with overburdened schedules.

It enables the executive to dictate at any time—before, during or after hours—without requiring the presence of a secretary, thus freeing her to perform other duties. Because a Dictaphone dictating machine is always available, the executive is encouraged to order his day so that individual matters are treated promptly—one at a time—as they come up. This modern business method is invaluable for correspondence, notes, memos, instructions and reports.

Experience has proved that in schools, as in the commercial world, Dictaphone doubles an executive's ability to get things done.

Dictaphone Equipment for Every Purpose

Dictaphone dictating machines are of two types—each ideally suited for the purposes for which they are intended.

The Dictaphone Cameo Model dictating machine operates at extremely low cost per recording.

The standard Acoustic equipment, represented by the Dictaphone Cameo Model dictating machine, employs the familiar speaking tube for recording.

Dictaphone Electronic dictating machines record either by means of a desk microphone or hand microphone. They afford the dictator complete ease and freedom of movement while dictating. Features of Dictaphone Electronic Dictation also include the ability to record both ends of telephone conversations and, under proper conditions, over-the-desk office conversations.

Dictaphone Electronic Dictation gives the executive complete ease and freedom of movement while dictating.

Both types are used with standard Dictaphone transcribing machines.

Business Opportunities for Dictaphone Transcriptionists

The extensive usefulness of the Dictaphone Method has created a constantly growing demand for Dictaphone-trained secretaries and transcriptionists. Make the Dictaphone Business Practice Course available to your students and encourage them to prepare for the responsible positions that are awaiting them now and in the post-war world.

Dictaphone Teaching Aids, Special Equipment and Courses

The Dictaphone Portfolio of Teaching Aids, containing samples of tests, charts and other material of definite help to business teachers, will be sent free on request. For information on special Dictaphone equipment and courses for teaching typewriting and speech improvement we suggest that you consult any Dictaphone representative, or write us direct.

The word DICTAPHONE is the registered trade-mark of Dictaphone Corporation, makers of dictating machines and other sound recording and reproducing equipment bearing said trade-mark.

UNDERWOOD CORPORATION

Typewriters, Accounting Machines and Adding Machines

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COMPLETE SERVICE IN ALL PRINCIPAL CITIES

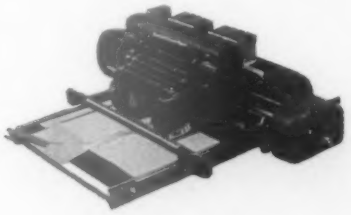
YOUR TYPEWRITERS, because of the present emergency, have become more valuable than ever. Your typists do their best to keep them at top efficiency by proper cleaning. But the best possible conservation measure is to take advantage of the Underwood Maintenance Agreement. This provides for *regular inspection* of your machines. It is, in effect, an insurance policy covering the efficient operation of your typewriters. Ask us for details.

AND better take care of those Underwood, Elliott Fisher and Sundstrand Accounting Machines, too! Remember this one thing. There is someone in the Underwood Maintenance Department always at the other end of the 'phone.

WHAT does this all add up to? Calling for Underwood Maintenance Service in time adds up to a heap of good sense . . . and helps your country. Today every Underwood Sundstrand Adding Machine is precious because it must be made to last longer. A Maintenance Agreement will do that and keep them in tip-top condition. And instruct your staff to call for Underwood service when any one of your machines gives less than its usual efficient performance.

Supplies, too, belong in your conservation program

Did you ever think of how important they are at a time like this? For instance, you want ribbons and carbon paper that give the clearest possible reproduction with longest possible wear. The answer is Underwood Corporation supplies. Who else should you turn to for such supplies, but the maker of the machines themselves?



Service Everywhere Through

A Nation-wide Organization

RALPH C. COXHEAD CORP.

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VARI-TYPER COMPOSING MACHINE SERVES SCHOOLS in these 3 ways:

★ To teach commercial students a new vocation

Operation of the Vari-Typer Composing Machine is a new training field with excellent placement possibilities. Thousands of organizations throughout all industries now use Vari-Typer, and the number is increasing rapidly. Reconversion will result in a highly competitive employment market. The student with Vari-Typer training will have a decided advantage over the ordinary typist. Vari-Typer operators are in demand. A well-written, easy-to-follow text book on operation is available.

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Vari-Typer's wide variety of changeable types enables students to produce outstanding scholastic publications. Vari-Typed entries in the Columbia Scholastic Press Association competition have been consistent winners for many years. The Vari-Typer method of composition permits a greater student participation in the make-up of the publication. Costs of producing a Vari-Typed publication are low -- an aid to balancing the budget.

★ To cut cost of administrative forms

Large savings in the production of office forms are effected by using the Vari-Typer Composing Machine. Selecting from the hundreds of different styles and sizes of types available, an office typist composes forms which look like type-set printing, but cost far less. Vari-Typer is used in conjunction with any modern duplicating or offset printing process. Savings range from 50 to 80 percent; Vari-Typer pays for itself, on an average, in less than a year.

TEXT COPY SET ON VARI-TYPER

VARI-TYPER USES OVER 600 DIFFERENT Sizes and Styles of Type

With the Vari-Typer Composing Machine, a typist composes *one original copy* of a form, for example, using large, bold types for headings, medium sized types for sub-headings, etc. She Vari-Types this original on a stencil, spirit or gelatin master paper, paper plate, or master paper for photo-offset, depending on the reproduction method to be used. The Vari-Typed original is then put on the duplicator or offset press and the required number of copies are reproduced. It's as simple as that. In this way administrative forms, examination papers, student publications, etc., are produced in less time, on less paper, and at lower cost.

Send for FREE folder

Vari-Typer can serve you, your faculty and students in other ways, too. For instance, your foreign language, mathematics, chemistry teachers will be glad to know that the Vari-Typer writes in all modern foreign languages and has mathematical and chemical symbols. Full details on Vari-Typer are available in a free 16-page illustrated booklet..., yours on request. Write for your copy today.

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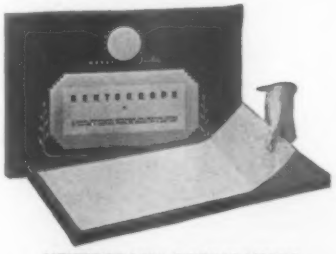

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We manufacture a complete list of rotary stencil duplicators which will soon be available. Our popular EFFICIENCY ROLL DUPLICATOR is now available.

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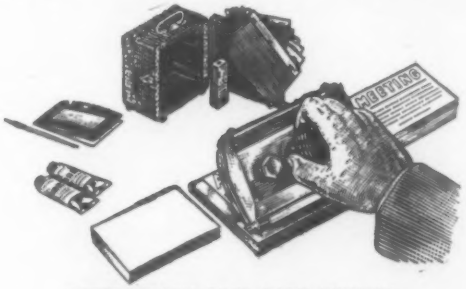

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Complete with Case, 6 Stencils, 2 Tubes of Ink, Correction Fluid, Stylus, StencilScope, Base and Instructions

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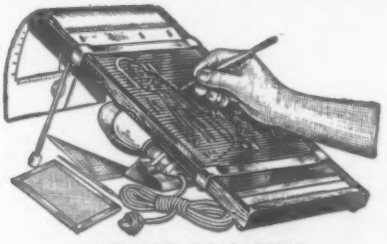
Finest in Inks, Carbon Paper, Pencils and Ribbons



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Simplifies Drawing and Tracing on Stencils. Complete with all Tools

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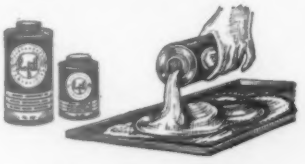
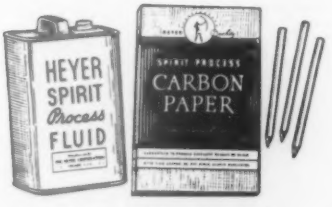
Finest reproductions for automatic hand duplicators. Black and 7 colors



HEYER Quality REFILL

For Any Pan Type. 1-2½-5 and 10-lb. Can



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SPIRIT CARBON PAPER for sharp, clean originals in Purple, Red, Green, Blue—Box of 100

SPIRIT PROCESS FLUID, assures maximum brilliant copies. No odor—Gallon Cans

HEYER Quality STYLI and GUIDES

18 Varieties of Styli points with plastic handles. Guides for many type faces and sizes

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Dept. U, Norwalk, Conn.

"Pioneers in All That's Best in Stapling"

Hotchkiss Staplers Prove Their Value in Classroom and School Office

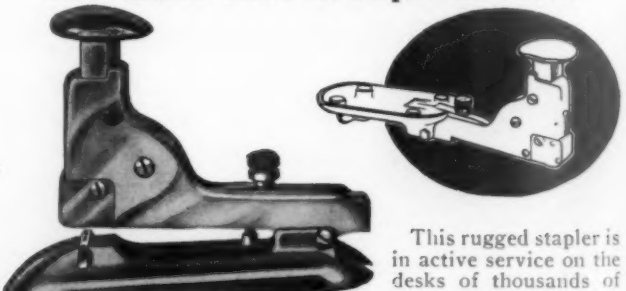
Classroom papers and business forms can be classified and organized better with them. Stapled papers occupy less space in file drawers. Staples require less wire and are economical to use. Hotchkiss staplers are made to stand hard usage and have given years of service in many schools.

HOTCHKISS Model 122P Stapler and Tacker

Here is a handy, double duty stapler and tacker that is small enough to fit in purse or pocket or it can be kept in a corner of the desk drawer. To staple papers, just squeeze it like a plier. It holds 105 economical standard size staples, the same size as are used by most of the larger desk models.

By swinging the base down and around it becomes a useful light duty tacker. Teachers like them for tacking up papers, for pinning drawings on drawing boards and hundreds of other uses.

HOTCHKISS Model 6A Stapler and Tacker



This rugged stapler is in active service on the desks of thousands of busy teachers. Its heavy, die-cast frame and base will stand the hardest use. The capacity of Model 6A is 105 Standard Size Staples and it is fitted with a duplex anvil which permits fastening papers with a permanent clinch or with the Hotchkiss exclusive temporary clinch. The latter type permits the staple to be removed like a pin with the fingers—a very handy feature.

The base may be swung down and locked back so as to use the machine for tacking papers and drawings to walls and drawing boards. Rubber feet in the base prevent scratching desks. Finished in handsome black crackle lacquer.

CHISEL-POINTED TRADE-MARK

HOTCHKISS Chisel-Pointed Staples

For Easy Stapling

These staples have keen chisel points and penetrate material easier than ordinary blunt pointed ones. They are made of correct gauge wire to micrometer exactness and fit the machines perfectly.

Have your local Hotchkiss Stationer or Wholesaler show them to you or write Hotchkiss direct. The Hotchkiss Guarantee is your protection.

AMPRO CORPORATION

2851 N. Western Avenue, Chicago, Ill.

Tested in a Worldwide Laboratory

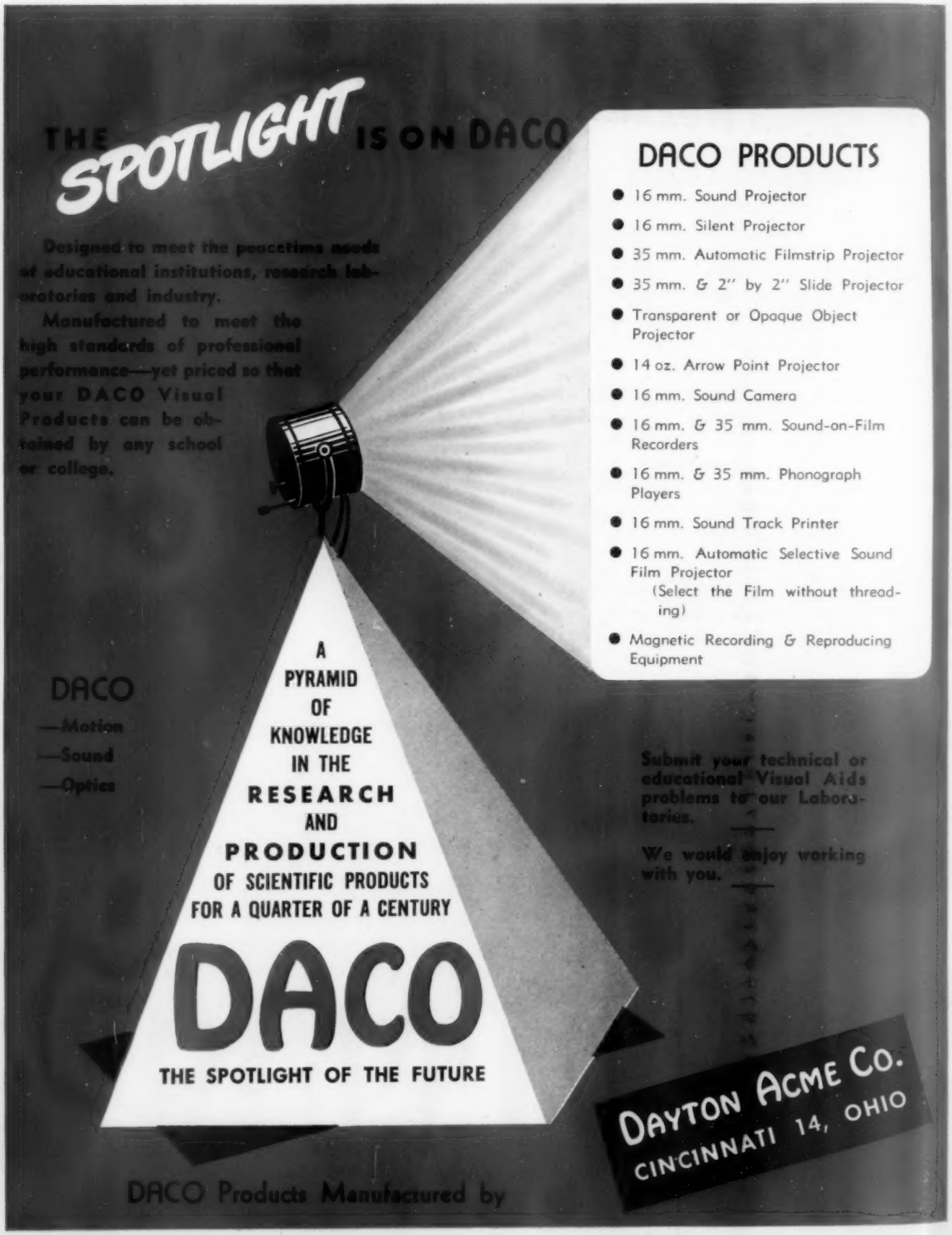
On far-spread fighting fronts Ampro 16 mm. sound projectors have been subjected to the most rigorous tests ever devised. As an integral part of the training and entertainment equipment of the armed services, these machines have had to stand steaming, corroding humidity — congealing, sub-zero temperatures — dust storms and jarring vibrations—plus day after day operation with a minimum of service facilities.

Add to this more than a decade of prewar experience in building 16 mm. projectors for thousands of schools, universities, industrial concerns, government agencies, churches, clubs and homes the world over—and you will understand why Ampro provides continuous, efficient operation under the most adverse conditions.

For full details on Ampro 8 mm. and 16 mm. projection equipment, write to Ampro Corporation, Chicago 18, Ill.

DAYTON ACME COMPANY

930 York Street, Cincinnati 14, Ohio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35 mm. & 2" by 2" Slide Projector
Transparent or Opaque Object Projector
14 oz. Arrow Point Projector
16 mm. Sound Camera
16 mm. & 35 mm. Sound-on-Film Recorders
16 mm. & 35 mm. Phonograph Players
16 mm. Sound Track Printer
16 mm. Automatic Selective Sound Film Projector
(Select the Film without threading)
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A PYRAMID OF KNOWLEDGE IN THE RESEARCH AND PRODUCTION OF SCIENTIFIC PRODUCTS FOR A QUARTER OF A CENTURY
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Operator of the Filmosound Library of Sound and Silent Films

Filmosounds are now even better than before, because they embody combat-tested results of Bell & Howell's war-accelerated research in Opti-onics

Do You Find FOOT-OF-THE-CLASS PUPILS A TOUGH TEACHING PROBLEM?

HERE'S ONE GOOD SOLUTION

Lagging pupils can hold back a whole class and nullify much of a teacher's best efforts. Tests show that slow pupils respond much more quickly to the **dual** stimulus of sight and sound provided by supplementing regular instruction with a Filmosound Projector and Filmosound Library films. And, of course, **star** pupils benefit, too!

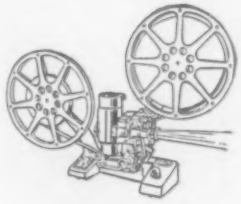
Thousands of professionally made films, with almost unlimited subect matter, can be rented or purchased from the Bell & Howell Filmosound Library. Send for your free copies of our catalogs of motion picture equipment and educational and recreational films.

B&H HELP NEVER ENDS

When your school buys a Filmosound Projector, or a Filmo Camera to make your own movies, or any other Bell & Howell product, you receive even more than the world's finest equipment. A nearby member of the nation-wide B&H staff of Visual Educational Specialists is always ready to survey your plans and help you perfect them. Use his wide knowledge of Visual Education. Write for complete information. Also write for the Bell & Howell "Architects' Visual Equipment Handbook," containing a wealth of information on how to provide for use of visual aids when planning school building construction or remodeling. No obligation.

Filmoarc 16 mm. arc lamp sound-on-film projector. Serves the largest audiences

Below—the B&H 16 mm. Filmotion Editor shows *motion* pictures on a miniature screen . . . is an invaluable aid in giving school-made films professional perfection



Filmo Showmaster Projector for 16 mm. silent film

Filmo 70-D 16 mm. Camera

BAUSCH & LOMB OPTICAL COMPANY

655 St. Paul Street, Rochester 2, N. Y.

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B BALOPTICON—For Slides Only

This extremely popular model is inexpensive, sturdy in construction, compact, easily portable and highly efficient. Its optical system is of exceptionally high quality. It can be fitted with optical systems adapting it to a wide range of projection distances. Maximum illumination. Extremely simple to operate. Strip film, micro-projector and overhead projector attachments are available.

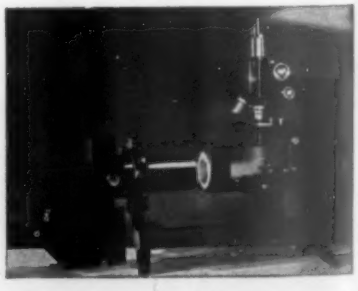
Model BDT is the same instrument as the B, but with a sturdy, tilting base, adjustable in two meridians. It permits leveling the Balopticon even when placed on an uneven surface. This mounting allows for changing the projection angle for screen at various heights.

B&L 2" X 2" SLIDE PROJECTOR

Manufactured to the high standards of performance that characterize all Bausch & Lomb projection equipment, the performance of the B&L 2" x 2" Slide Projector is characterized by brilliant, crisp, sharply defined screen images plus comfort, safety and convenience in operation. Shows black and white or color transparencies. An ideal instrument for projecting slides made by the instructor or by the students themselves.

This instrument is substantially made and is fitted with a high efficiency Bausch & Lomb optical system. This consists of a 150 watt, single contact base bulb with a silvered, concave reflector, a triple lens condenser, one lens of which is heat absorbing, and a five-inch f:3.8 B&L Cinephor Projection lens of the same type as used in professional motion picture projectors. Slide carrier permits use of cardboard, metal or glass mounted slides.

MODEL B MICRO-PROJECTOR



The Model B Micro-Projector fills teaching needs in many fields. Any department where a compound microscope is used, by the addition of this instrument, can enjoy the advantage of efficient and economical micro-projection.

Simply place the microscope on the stage of the projector in an upright position, apply the prism reflector cap to the microscope and focus the illuminator. Complete directions accompany each projector.

Investigate this instrument before completing your plans for science laboratory development.

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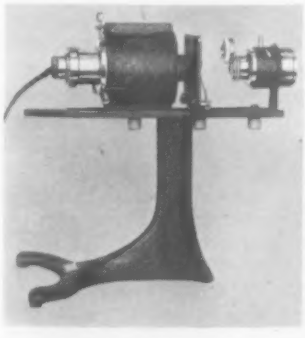
LRM AND ERM BALOPTICONS FOR OPAQUE OBJECTS AND LANTERN SLIDES

The ERM and LRM Balopticons for lantern slides and opaque objects give brilliantly sharp screen images under actual classroom conditions. An improved Built-In Blower-Cooling System efficiently safeguards objects being projected. The improved object holder is entirely free from interfering obstructions and permits projection of 6"x6⅜" areas of large maps, drawings or photographs. The door is arranged for convenience in placing solid objects in the projection area.



TRIPLE-PURPOSE MICRO-PROJECTOR

Especially designed and priced for high schools, this extremely efficient unit serves three definite purposes: (1) projection of permanently mounted specimens on a screen from 4 to 15 feet away. (2) making drawings of microscopic fields. (3) projection of living specimens in liquids. Exceptionally sturdy in construction. Has both coarse and fine focusing adjustment. A two-power projection lens is included.

BALOPTICON TABLE

The B&L Balopticon Table provides a means of placing a Balopticon where it can be used to best advantage. It is portable (rollers on two front legs), and has a shelf underneath for slide boxes.

SEND FOR CATALOGS

Catalog E-11 "Balopticons and Accessories," completely describes our line of Balopticons, many of which were omitted here due to lack of space. Micro-Projectors for school and college use are the subjects for Catalog E-20. For information on Bausch & Lomb Microscopes and Spectrographs see pages 458, 459 of this book.

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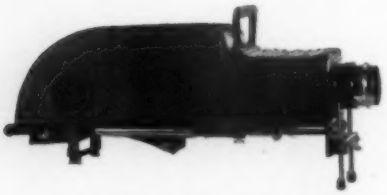
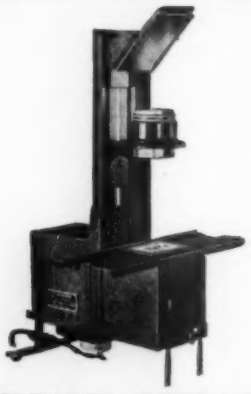


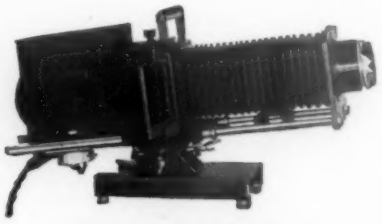
SPENCER MODEL GK

Spencer Delineascope Model GK, supplied with a 750 watt bulb, is an extremely powerful yet safe projector for 2" x 2" or 3¼" x 4" color slides. It provides ample brilliance for auditorium use. With an iris diaphragm, light intensity may be controlled accurately for small audiences. Slide protection is assured by an ingenious cooling system, including a rheostat controlled universal motor driven fan, and a heat filter of unique design. Interchangeable condensing systems concentrate the light for use with small or large size slides.



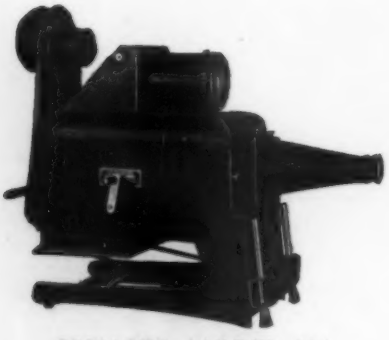
SPENCER MODEL B

The Spencer Model B Delineascope may be used on the desk or lecture table for science demonstrations. The instructor may project 3¼" x 4" slides, translucent or transparent specimens in petrie dishes and silhouettes of small objects. Experiments in biology and physics may be made on the projection platform and the action is magnified by projection to the screen. The projection screen is placed back of the instructor and above his head. The instrument occupies very little space (47/8 x 11¼), has an adjustable mirror for centering the picture on the screen and has a durable black crinkled finish. Bright parts are chromium plated.



SPENCER MODEL D

Spencer Model D is for projecting 3¼" x 4" lantern slides. It has several features for the convenience of the teacher —a non-heat conducting handle; an elevating and tilting device for locating the picture on the screen; an aperture in the side of the lamphouse to illuminate manuscripts; well designed optical system to insure remarkably sharp, brilliant pictures. A slide carrier for 2" x 2" slides is available. The Model D is sturdy, extremely lightweight and portable.



SPENCER MODEL VA

The Spencer Combination Delineascope Model VA will project lantern slides, postcards, photographs, drawings, pages in books and mineral and biological specimens. Illustrations in books of many sizes may be projected. The change from glass slides to opaque material can be made almost instantaneously by turning a handle at the side of the instrument. An improved elevating device facilitates centering the picture on the screen. This instrument is furnished with the cooling fan only. A filmslide attachment for 35mm. single frame slide film may be added.

SPENCER MICROFILM READER

The Spencer Microfilm Reader is designed to reproduce the microscopic characters of microfilm. It consists of a projection head, a glass film book and the shadow box and screen. The projection head is a modern, optical projection system with a specially designed projection lens. The head is held by spring clips to the shadow box and may be rotated to project the film in either a vertical or horizontal azimuth. The image is so protected by the shadow box that a darkened room is unnecessary.

SPENCER MODEL MK

The Spencer Model MK Delineascope for 2" x 2" slides, is a quality projector of exceptional efficiency. Its optical system projects images of a uniform brilliance and clarity. A large, well-ventilated lamphouse keeps the equipment cool enough to handle at all times. Sharp definition is secured with all models by the well corrected Spencer projection lens of 5" focal length with a speed of f:3.75. The MK200 shown above may be converted into an MK300 by adding the fan cooling unit and changing the bulb.

Opaque Projection Effective and Economical

As far back as the early Greeks, visual aids were used by pedagogues to supplement lessons. Class journeys were considered very valuable and actual objects were used for demonstration purposes.

Through the years, these ideas were carried on by such noted educators as Froebel, Herbart and Dewey, who were constantly striving to limit formalism and bookishness. Today, through the efforts of these individuals and the arts of photography and printing, subject matter can be presented visually, through charts and pictures, as well as orally.

One of the most useful visual aids in the classroom is the Spencer Combination VA Delineascope. It is invaluable in the rapidly growing field of visual education, since it projects lantern slides, postcards, photographs, drawings, pages in books and mineral and biological specimens. It can be used in the teaching of all subjects at all levels and meets the demands of city or rural schools, high schools and universities. When properly used, it is a time and money saver.

Today, when so many phases of our life are changing rapidly, this instrument can be used to keep illustrative material up-to-date. Illustrations which were good teaching material a year ago, now are becoming obsolete and must be replaced if the teaching program is to keep up with current trends and developments. With a combination projector it is a simple matter to omit slides or pictures from a unit and substitute new illustrations.

The following are some of the advantages in using the opaque projector:

1. Materials made or assembled by both the instructor or the students may be used.
2. It centers the attention of the pupils.
3. The instructor can make use of a tremendous amount of material not available for films or slides.
4. Still projection allows ample time for discussion of material projected on the screen.
5. Both the instrument and the materials for use with it are inexpensive.

Visual aids have also been used in various other capacities. Surgeons use drawings and color slides in lectures to nurses in training. The Army uses projectors to speed training of men in service. Industrial plants build morale and train workers with illustrated lectures in conjunction with motion pictures.

Below: **STUDENT USING VA DELINEASCOPE**

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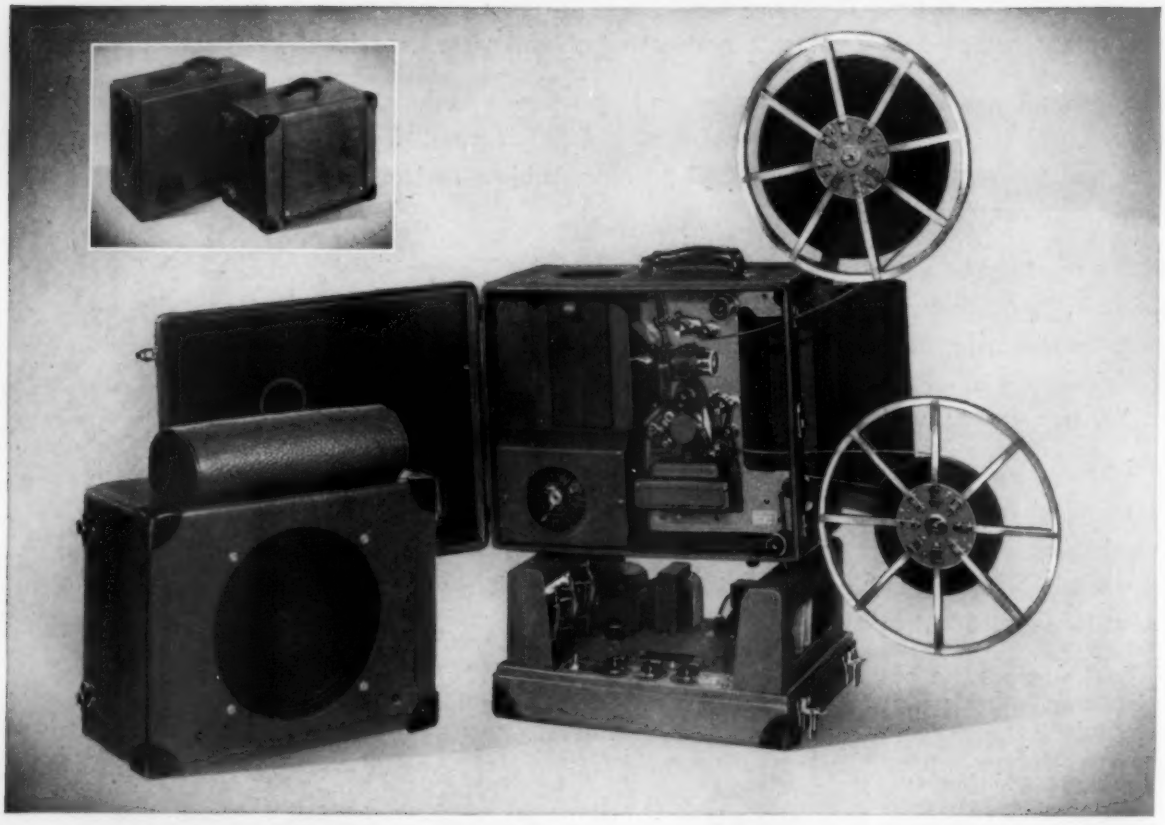

The new DEVRY is a Triple-Value Instrument!

1 **You Can Safely Project BOTH 16mm. Sound and Silent Films**

HERE is a champion performer. From DeVry's long experience in precise and careful manufacture, from the magic of electronics, optics and mechanics comes this superb new projector—a watch-like precision machine overflowing with quality and reliability for years and years of hard usage.

4 Time Winner

DeVRY alone has been awarded four consecutive Army-Navy E's for Excellence in the production of Motion Picture Sound Equipment.

2 **You Can Show BOTH Black and White and Color Films Without Added Equipment**

The new Model "16-1966" DeVry is a 16mm. projector that measures up to theatre standards in performance. Having built professional 35mm. projectors and sound systems for better theatres all over the world, DeVry **knows** the essential requirements which make theatre quality — and so incorporated these requirements into this new 16mm. sound-on-film projector.

The new DeVry is unique among 16mm. sound-on-film projectors in that it is not a silent machine with "something added," but a projector designed and built "from the ground up" expressly for 16mm. sound-on-film projection. You are assured of perfect sound and picture synchronization.

3 **Separate Amplifier and Speaker Gives You Portable Public Address Facilities**

The projector is self-contained in a sturdy case that affords protection in travel and that silences mechanical sounds when in operation. A second balanced case holds the 25 watt amplifier and 12 inch electro-dynamic speaker. The two cases appear as a matched set of fine luggage.

The DeVry is so simple in design and construction, so easy to set up, so error-proof in operation that the teacher can feel free to turn this procedure over to any student. To hear the new moderately priced DeVry reproduce clarion clear, "Nature-Real" sound —to see it project brilliant, sharp, flickerless pictures that are easy on the eyes, is a thrill that awaits you.

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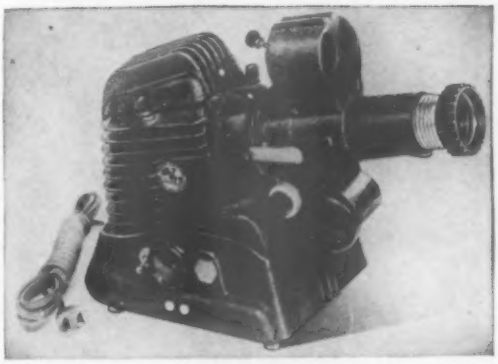
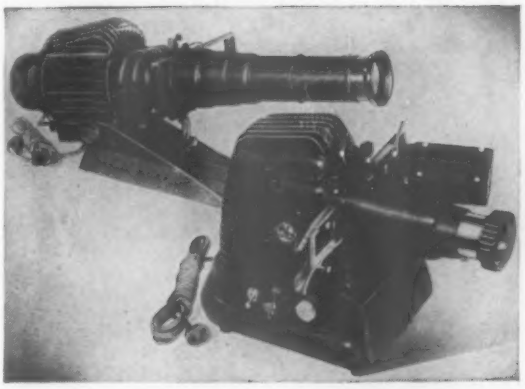


SLIDE FILM PROJECTORS
DeVRY Triple - Purpose Slidefilm Projector (Left) for (1) 2"x2" paper and glass slides; (2) for single-frame slidefilm; (3) for double-frame slidefilm—with motor driven forced-air cooling.

MICROPHONES
DeVRY High - Impedance Microphones (Right)—either dynamic or crystal—deliver high-quality reproduction. Fit any standard stand.

RECORD TURNTABLES
DeVRY Phono - Record Turntables —two speed operation—33 1/3 and 78 RPM—take records up to 16". True tracking crystal pickup arm. "For 60 cycle A.C. operation only."



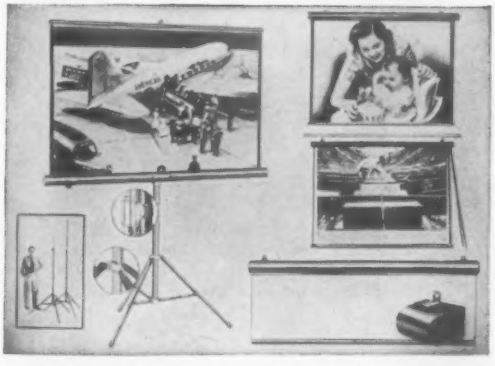
STEREOPTICONS
DeVRY Stereopticon (Left) with motor driven forced air cooling permitting efficient use of 1000 watt lamps.

SLIDE PROJECTORS
DeVRY Slide Projector (Left) with 300 watt lamp; for 2"x2" paper or glass slides.

SLIDES — VIEWERS
2"x2" Color Slides (Right)—Famous American Masterpieces. Over 700 beautiful slides to select from.

Disney Color Slides (Right)—Famous Walt Disney characters in 35mm. full color 2"x2" slides.

Hollywood Viewers (Right)—for crystal clear magnification of 35mm. 2"x2" slides.



SCREENS — ALL TYPES
DeVRY Projection Screens are immediately available in sizes from 30"x40" to 20'x20' in portable tripod, wall and wall and ceiling models. Features the famous "HY-FLECT" Screen surface for brighter, clearer pictures.

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DeVRY 16mm. Movie Cameras for shooting personal or school movies in black and white or natural color. Holds full 100 ft. reels of film. Its famous 35mm. brother shot Academy Word winning DESERT VICTORY.

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The BEST Projector is the BESELER Projector

Here are two of the many different types of BESELER projectors, designed to solve school projection problems:

***Model OA*— This new BESELER opaque projector weighs only 11 lbs. and is easily portable. Projection stage is located in front for convenience. Handles all opaque material up to 4¾" x 5". Faithfully projects colors and details in correct left-right relations. Costs only $29.50..Gives good screen performance. (Pat. pending)**

***Model OA2*— One of the most popular models for both opaque and transparent projection. Provides more screen illumination and is readily convertible from opaque paper to standard lantern slide projector. It has a special attachment which accommodates single and double-width film and 2" x 2" Kodachrome slides.**

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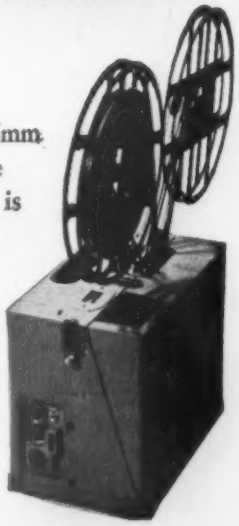

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EDUCATIONAL DEPARTMENT, RCA VICTOR DIVISION

Camden, New Jersey

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16 MM Projectors bring sound movies into the school to familiarize the student with the appearance and sound of persons and places, to illustrate how things work. The RCA Projector for schools is simple to use. It includes many important advances in projector design.

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FM Transmitters and Receivers by RCA provide the finest in FM equipment for every broadcast need — for better reception and for FM demonstration in the school.

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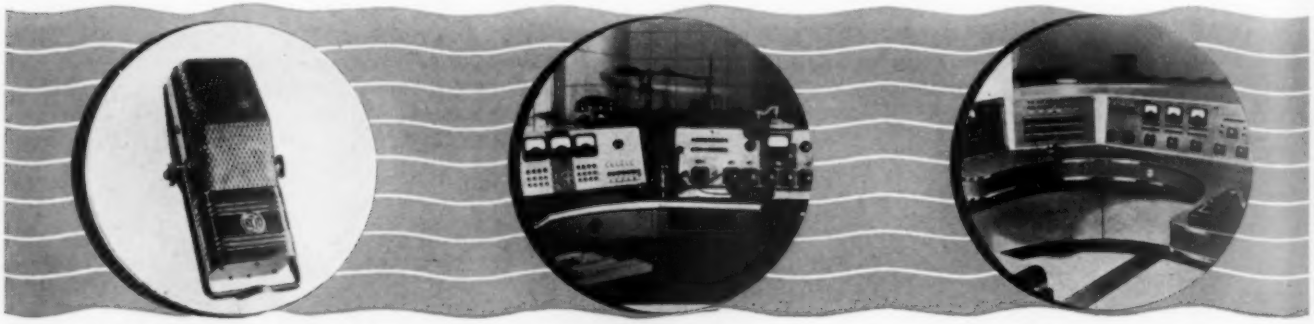
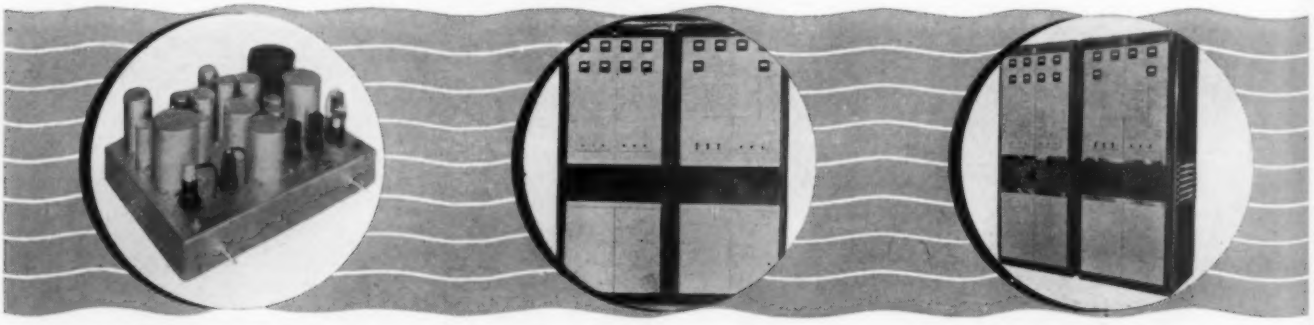
Before the war, RCA engineers had designed a complete line of equipment for FM broadcast stations. A considerable number of RCA-built, FM broadcast transmitters were installed and are on the air today. In the important (because it is chiefly used in New York, Chicago and other metropolitan centers) 10KW category, for instance, five RCA 10KW, FM transmitters have been installed. More than of any other make. An additional quantity of these transmitters was built but was diverted for war purposes.



1. HIGH FIDELITY MICROPHONES —The RCA 44-BX Microphone is the standard of the industry. After the war, RCA will have even better microphones, insuring maximum FM response characteristics.

2. STUDIO CONSOLETTES — The RCA 76-B2 Consolette is well-suited for small and medium-sized FM stations and the individual studio booths of larger stations. Complete facilities for two studios, booth announcements, turntables, remotes, etc.

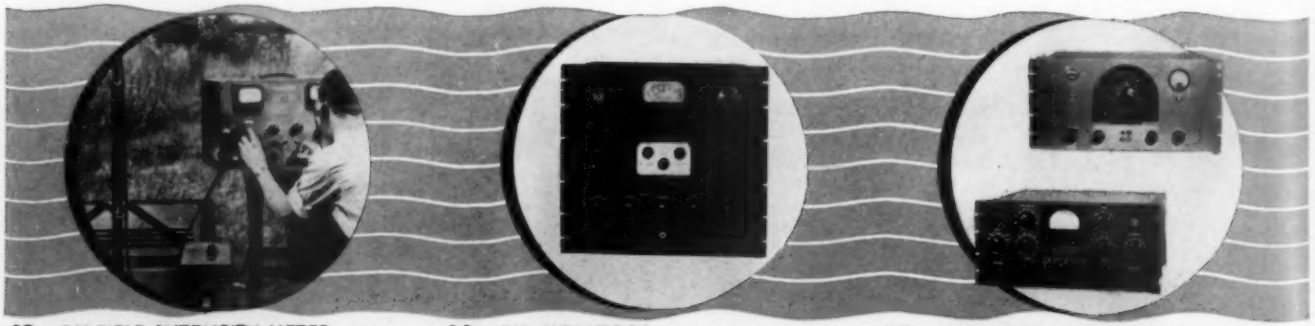
3. STUDIO CONSOLES — RCA, custom-built studio consoles are ideal for the high-quality requirements of FM. Shown here is the control console of FM Station WBRL, Baton Rouge, La.



7. HIGH-QUALITY AMPLIFIERS—The several types of standard, RCA studio amplifiers are well-suited for FM use. All amplifiers have a flat frequency response, which may be compensated, when desired, for particular installations.

8. 1 KW FM TRANSMITTER—This is the RCA FM-1-B Transmitter, built before the war, a number of which were installed and are in operation. After the war, RCA will offer a complete new line of FM transmitters of all powers.

9. 3 KW FM TRANSMITTER—This is the RCA FM-3-B Transmitter, built and sold before the war. The same exciter is used in all RCA FM Transmitters from 1 KW to 50 KW.



13. FM FIELD-INTENSITY METER—The RCA 301-B Field Intensity Meter, which has a frequency range of 20 to 125 megacycles—and a built-in discriminator circuit—is the only commercially produced unit suitable for FM use.

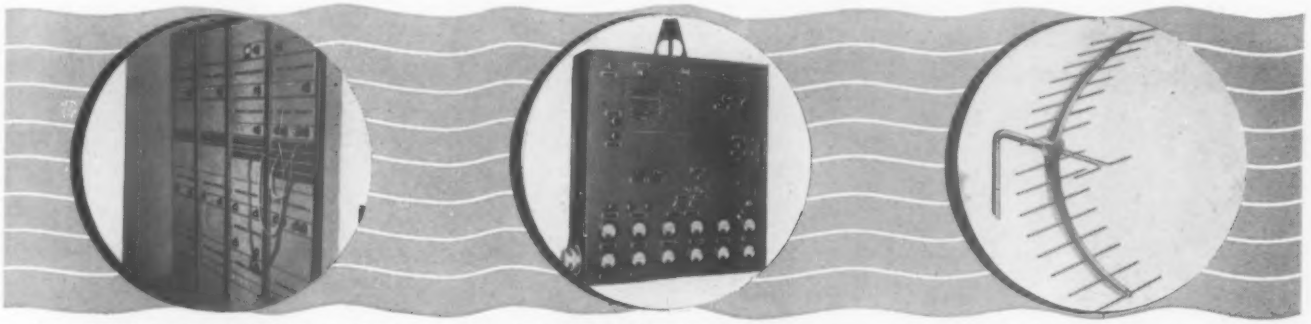
14. FM MONITORS — RCA FM frequency monitors and FM modulation monitors are the finest built for this specific purpose—are fully approved by the FCC for FM station use.

15. MEASURING EQUIPMENT — For making "proof-of-performance" measurements of AM noise level, FM noise level, frequency response and distortion, the RCA 68-B Oscillator and 69-C Distortion Meter are recommended.

FM Broadcast Stations

RCA FM transmitters were designed and built along the lines of the exceedingly successful RCA AM transmitters. They are built that way because it is felt that station engineers want in their FM transmitters the same qualities of convenience, reliability and appearance that they have come to expect in AM equipment.

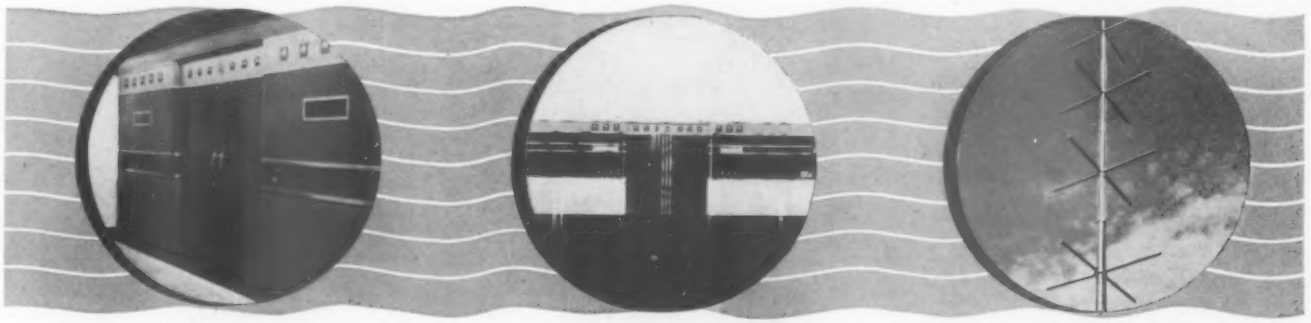
After the war, RCA will offer a complete new FM line which will incorporate the much superior, RCA-developed locked-in oscillator circuit and other improved features.



4. *STUDIO EQUIPMENT RACKS* —RCA studio assemblies for use with or without custom-built consoles are also well-adapted for FM —can be built to incorporate any facilities desired. These are the studio equipment racks at WBRL.

5. *RELAY TRANSMITTER* — RCA has built many types of relay transmitters, including the television transmitter shown here. After the war, RCA will have a new, simplified relay transmitter especially designed for FM stations.

6. *RELAY ANTENNAS* — The directional or beam antenna, such as that shown here, is largely based on RCA research. After the war, RCA will offer a special type for FM relay service.



10. *10 KW FM TRANSMITTER* — This RCA FM-10-A Transmitter at NBC, New York is one of five in this power size which were installed before the war.

11. *50 KW FM TRANSMITTER* — This is the RCA FM-50-A Transmitter which was under construction when the war began. After the war, RCA will have a new 50 KW design incorporating many unique features.

12. *FM ANTENNAS* — The turnstile antenna — symbol of FM broadcasting — was developed by Dr. G. H. Brown of the RCA Laboratories. After the war, RCA will sell directly a new and improved design — much easier to install and requiring no tuning in the field.

16. *MONITORING ASSEMBLIES* — Transmitter audio equipment and monitoring equipment can be mounted in standard RCA racks to match other RCA units. Racks shown here are those at WBRL, Baton Rouge.

RCA RADIO CORPORATION OF AMERICA

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THE SIMPLIFIED FILM PATH IS SO EASY TO FOLLOW

Rapid, accurate threading is possible with the RCA film path. Note the four easy steps.

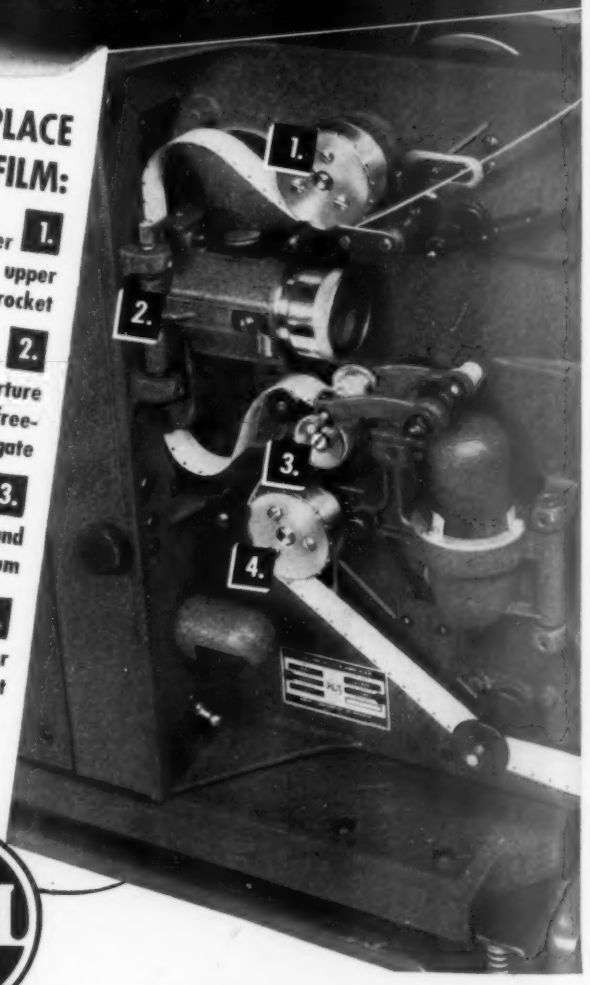
PLACE FILM:

under 1. large upper sprocket

in 2. aperture behind free-swinging gate

around 3. the sound drum

and under 4. the large lower sprocket



RCA 16MM Projectors are simple for teachers and students to operate... threaded in a moment, the film is ready to screen.

You get longer film life: The large, slow-speed sprockets are gentle on your film; the free-swinging gate makes it easy to adjust film in the aperture; an embossed threading-line provides a guide for exact length of upper and lower loops; the recessed sprockets and rollers prevent picture or sound-track area from touching metal; the sweeping curve of the film path has no sharp bends to kink your film.

Other features: The new RCA 16MM projector will include other important advances in projector design, such as even-tension take-up; coated lenses; completely removable gate; amplifier with inverse feedback for true sound; rewind without changing reels; standard tubes and lamps; sound stabilizer to keep sound on pitch; aero-dynamic cooling to prevent hot spots; lower film-loop adjustable while in operation; theatrical framing.

Availability: Because of military demands, these new RCA projectors may not now be available for civilian use. But investigate the new RCA projector before you plan postwar purchases for your school. Write: Educational Department 43-S, Radio Corporation of America, Camden, New Jersey.

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

LEADS THE WAY.. *In Radio.. Television.. Tubes.. Phonographs.. Records.. Electronics*

GENERAL ELECTRIC COMPANY

ELECTRONIC AIDS FOR EDUCATION

FM RADIO
•
TELEVISION
•
PUBLIC ADDRESS SYSTEMS
•
SPECIALIZED ELECTRONIC EQUIPMENT

Radio, television, and electronics are new tools for teaching destined to play important roles in the educational processes of tomorrow. They provide the means to reach vast audiences not only in schoolrooms but also in homes, throughout community, county, or state.

Educational radio can bring important benefits to students studying subjects in every field of learning.

New opportunities are opened in the presentation of many curricular subjects. There can be fresh emphasis on such features as news and current events, music, guidance service, adult education, subject motivation, and extension service from universities.

Radio broadcasting and public address systems have already notably benefited education. Today, educators are making plans for using radio and other electronic equipment, such as the G-E magnetic wire recorder, in their educational systems.

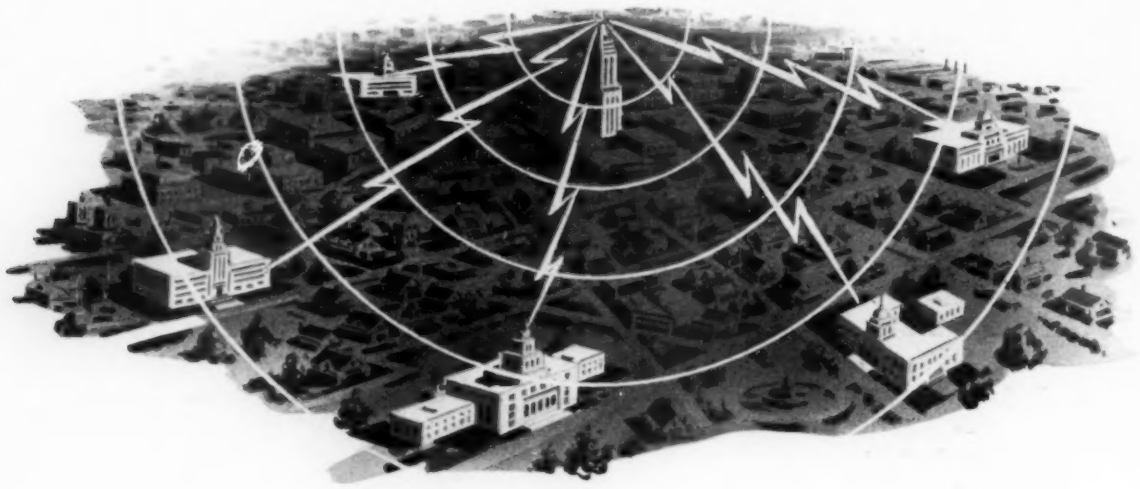
G-E FM CIRCULAR ANTENNA
An exclusive development of General Electric, this FM broadcast antenna is capable of increasing effective radiated power as much as eight times and provides substantially equal coverage in all directions. It is economical to install and to maintain.

Now Is the Time to Plan Your Installation

Consider carefully the future part that radio broadcasting, television, and electronics will take in *your* school system—then make provision in your building plans to include the proper facilities to accommodate their installation.

For FM radio, television, and electronic equipment to meet every requirement of your educational program, look to General Electric. G-E will supply everything in these fields for classroom, laboratory, and the home. See your G-E representative for complete details on this new medium of teaching, or write: *Electronics Department, General Electric, Schenectady 5, N. Y.*

Establish a priority on delivery of your broadcast equipment. Write for your copy of the "G-E Equipment Reservation Plan." It explains how to order and obtain your equipment at the earliest possible date.



G-E FM radio can reach every classroom and home in your community.

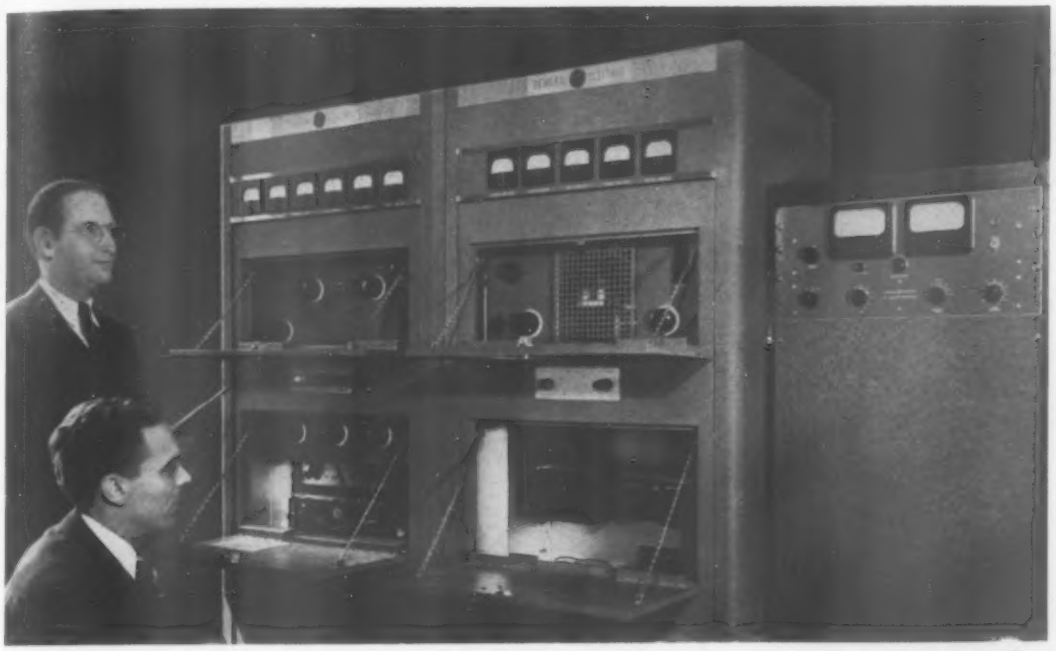
EDUCATIONAL FM BROADCASTING— now recognized by the FCC as a new public service

FM has been chosen as the best-fitted radio medium for transmitting educational radio programs. The Federal Communications Commission has already assigned special radio-frequency channels for exclusive use by schools and colleges, with adequate space in the radio spectrum for more than 1000 FM educational stations. Thus, there is adequate opportunity for *all* schools and school systems to install radio educational services.

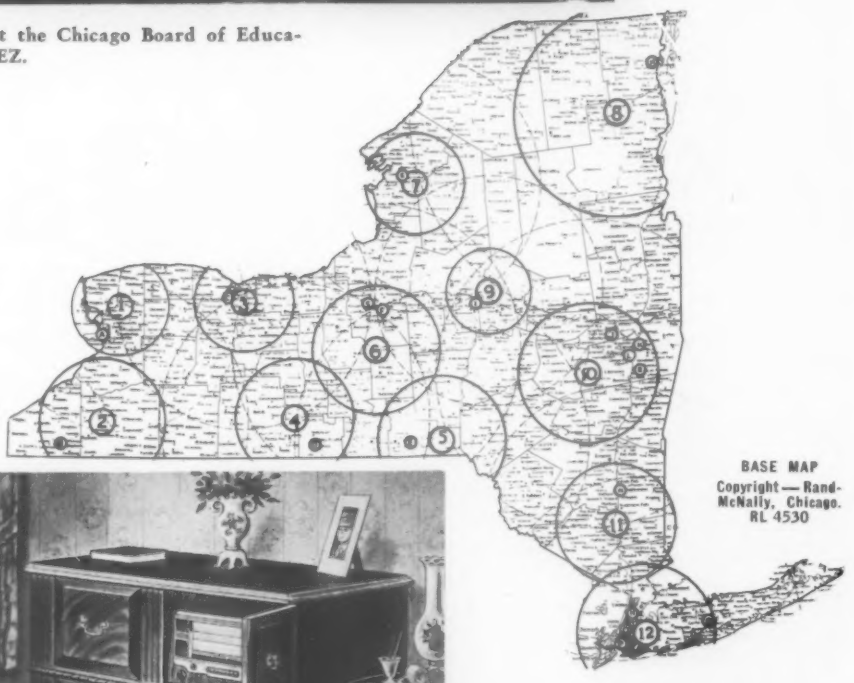
General Electric FM radio is an entirely new kind of radio that provides clear, bell-like reception against a background of silence. It eliminates virtually all noises caused by static and electrical disturbances, gives the listener reception with more than twice the tone range of ordinary radio. To the educator, FM offers a new method of teaching. It will be especially valuable for courses in music appreciation because it alone can provide the full tone range of orchestral instruments.

FM broadcasting is economical from the standpoint of power and maintenance costs—for with the same amount of transmitter power, an FM station is capable of serving greater areas with better reception.

Student participation programs enable students to become familiar with radio presentation technique—to take first steps toward greater careers.



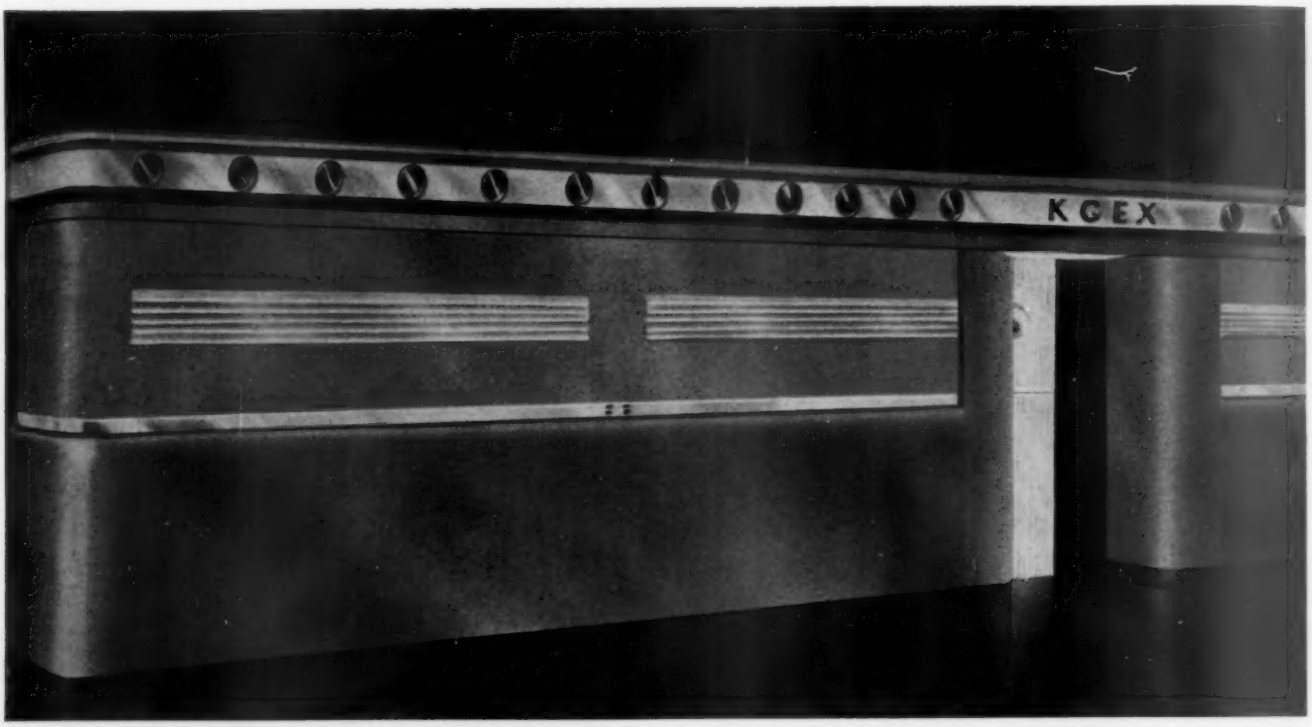
The General Electric 1-kw FM transmitter at the Chicago Board of Education station, WBEZ.



Proposed FM educational network for New York. This map shows how FM transmitters can be located at centers where programs can be originated to serve the major part of the population of the state of New York.

FM radio can bring education to people where they live—in urban, suburban, and country areas.

G-E FM RADIO—A NEW ERA IN SOUND BROADCASTING FOR TEACHING



The new G-E 100-kw international AM transmitter is setting the pattern for tomorrow's broadcast equipment in FM, Television, and AM. General Electric's radio equipment will include new circuit developments, new component designs, and improved layout features that will contribute to the quality and economy of your educational broadcasting system.

In addition to FM equipment, General Electric will continue to make AM broadcast equipment for commercial and educational use. This equipment will be of advanced design and built to meet the needs of the modern broadcaster.

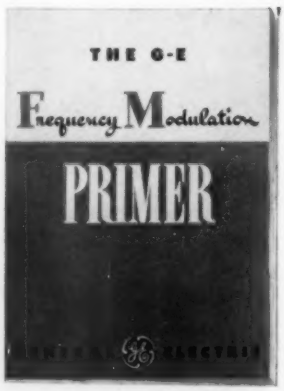
FM is applicable to community, county, or statewide broadcast service. One station, erected at the approximate cost of two modern classrooms, will normally serve all schools and homes within an entire community. FM reception may be obtained by means of individual receivers in each classroom, or by means of a central receiver which in turn will supply programs to every classroom through G-E public address systems. Home audiences need only tune their FM radio to the educational channels adjacent to the commercial broadcast channels in order to hear educational programs.

When you plan your FM station, look to General Electric. G-E is the one radio manufacturer with experience in designing and building complete systems—including transmitters, studio equipment, and home receivers. G-E has designed and built more FM broadcast transmitters than any other manufacturer. G-E built the first FM home receivers and has furnished a large percentage of today's half-million now in use. General Electric operates its own proving-ground at Schenectady comprising the 3-kw transmitter WGFM, S-T radio relay, and studio facilities.

G-E FM Motion Picture and Booklets Are Available for You

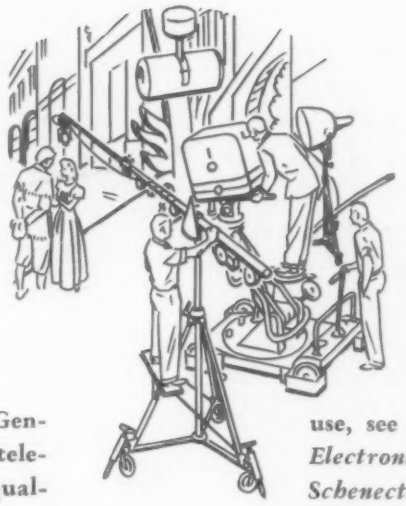
The General Electric film—THE STORY OF FM—is available to any school administrator who wishes to acquaint his community with the advantages of FM radio. In full color, this film tells the story of FM broadcasting in easily understandable, every-day language.

The G-E FM Primer also tells in simple terms how frequency modulation works, and Radio Broadcasting Post-War which shows General Electric's important place in modern broadcasting. Civic leaders and educators will find this information of great interest.



G-E TELEVISION AND INTRA-TEL SYSTEMS GIVE EDUCATION A NEW DIMENSION

Television by General Electric offers to the educator the most effective teaching stimulus in the history of teaching. Here is the medium that sets the printed word to pictures, that brings the arts and sciences to life. With it, a vast new interest in education will be cultivated—for television is a dynamic teaching aid that can accelerate child and adult interest in learning far beyond present limits.



Of direct interest to educators is General Electric's Intra-Tel system — television-by-wire that can pick up high-quality pictures and sound and convey them anywhere within a school building, or group of school buildings. Thus, it is possible to conduct special demonstrations at one location and show them to students in any number of classrooms. If desired, a motion-picture projector and film pick-up camera can be added to the system to provide motion pictures for all classrooms from one central point. Provision can also be made to link the system with a television broadcast station and thus serve an entire community with educational television programs. In addition to television and Intra-Tel systems, General Electric will also have direct-viewing and projection television receivers for individual classrooms and for home use.

Many educators are visiting General Electric's greatest television station, WRGB, at Schenectady, the most powerful in the world. This station includes all of the studio equipment and all of the transmitter equipment necessary for modern broadcasting. It is a work-shop station maintained as a proving-ground for equipment and programs. For details on G-E television equipment for educational use, see your G-E representative, or write: *Electronics Department, General Electric, Schenectady 5, N. Y.*

Television will bring the printed word to life, illustrate spoken words. It will accelerate the processes of learning.

General Electric's workshop television station WRGB at Schenectady is the largest and best-equipped station in the world.

SIGHTSEEING AT HOME is a 16mm sound-motion picture that tells the story of television. It is available to every educator for showing to his board and community. Ask your G-E representative how to obtain a print of this film for use in your school.

Write for your copy of TELEVISION BROADCASTING POST-WAR, a 24-page story in color that shows you the part that television by General Electric will play in future broadcasting.

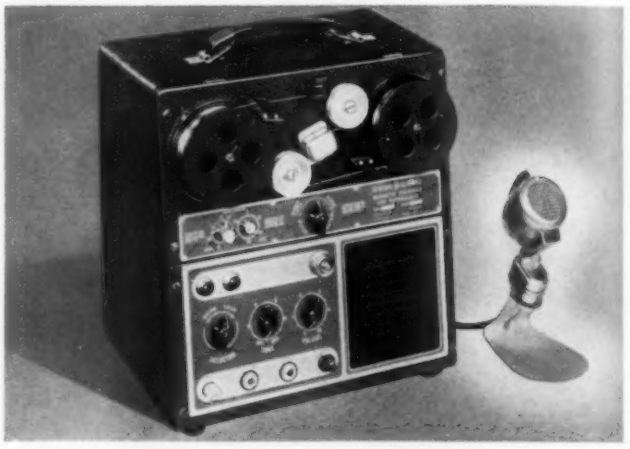
G-E MAGNETIC WIRE RECORDER

The General Electric Magnetic Wire Recorder is a new electronic development which has been widely used by the armed forces. During the war period, practically all production of this instrument has gone to them. In the post-war period, the wire recorder will find wide application in the field of education, particularly in those subjects where oral techniques are emphasized.

Since the playing time on a single spool is approximately sixty-six minutes, it is possible to cover an entire class period in almost any subject. Each spool contains nearly two miles of very thin, specially treated steel wire on which the recording is made. As the wire is wound on to the empty spool it passes through a recording head which forms a magnetic pattern of sound on the wire.

Proposed wire recorder unit for educational use.

The G-E wire recorder is easy to operate and will be found extremely economical because recordings can be erased magnetically and the wire may be used again and again. The recording can also be played back immediately, or if desired, the spools can be stored and played back at a later period. One model of the postwar recorder will be designed especially for educational purposes. It will include not only the recording function but also an FM and short-wave radio receiver so that programs can be taken off the air and played back. In the proposed model (see cut) all equipment will be housed in a neat, steel cabinet mounted on casters, which can be moved from room to room as required. For complete information write: *Electronics Department, General Electric, Syracuse, N. Y.*



Type 51, G-E magnetic wire recorder.

G-E ELECTRONIC TUBES

Electronic tubes are the heart of electronic equipment. General Electric pioneered many of the key tube developments—today builds every type and size of tube, from big water-cooled power tubes for radio transmitters to tiny "midget" types which are employed in hearing-aid equipment. Backed by the world's foremost research, General Electric tubes are outstanding in quality and long life.

G-E tubes in G-E electronic equipment—for educational broadcasting or laboratory use—make up a team on which you can rely for high-grade performance and complete dependability. For full information write: *Electronics Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Leaders in Electronics for Education

Small G-E transmitting tube GL-807 NY-6072

G-E Phototube FS-405 NY-5837

G-E Metal Receiving tube NY-5955

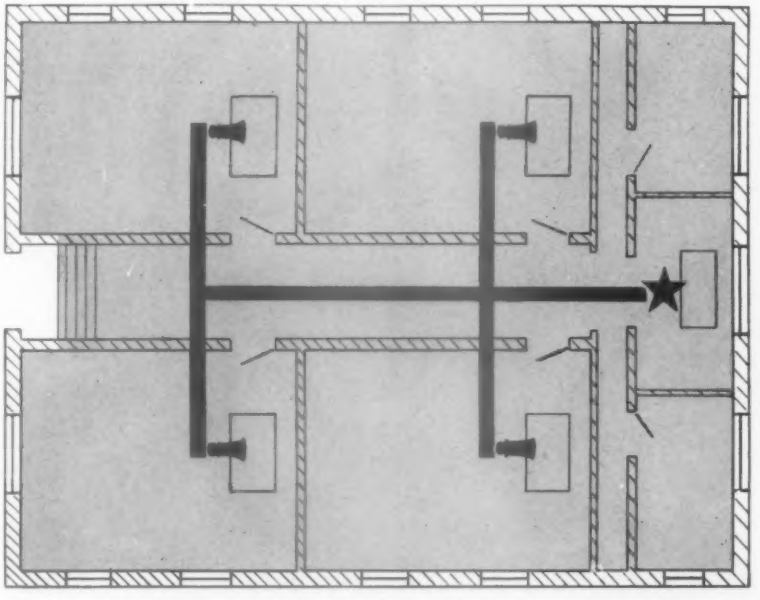
THE AMERICAN SCHOOL AND UNIVERSITY—1945

G-E PUBLIC ADDRESS SYSTEMS

The modern Public Address system is accepted today by teachers in all phases of education as an essential tool in their profession. Its widespread usage covering every type of institution from the rural consolidated school to the large university indicates the importance attached to it as a vital teaching aid. The functions of the sound system in schools are many and varied.

A few of the important uses are:

- General routine school announcements.
- Emergency announcements.
- Broadcasting radio programs to all or to individual classrooms.
- Radio workshop to train students in microphone techniques.
- Production of special programs.
- Training in dramatics.
- Classes in speech improvement.
- Playground and athletic activities.



General Electric will have a complete line of sound systems, especially designed for educational use. These will embody all the advances in sound development that have been an essential part of the General Electric research program during the war period.

Systems will be available for institutions varying in size from the smallest school to the large school or university.

When planning the erection of a new educational structure, keep in mind that a sound system is an extremely important part of your teaching facilities and that General Electric with its background of research can best supply the technical equipment and information for you. Write to *Electronics Department, General Electric, Syracuse, N. Y.*

MEASURING AND TEST EQUIPMENT FOR LABORATORY AND PRODUCTION

During the past few years tremendous advances have been made in the art of electronics, particularly during the war period when vast quantities of electronic apparatus were required by the armed forces.

General Electric, long recognized as the leader in making this type of equipment, has produced more than any other manufacturer of home radio receivers.

As an integral part of this production and research, General Electric has developed the finest and most complete line of laboratory and production equipment, both for military and industrial applications.

With the ever-widening use of electronics in industry it is supremely important that the student become familiar with the basic equipment used in precision processes.

Illustrated are several widely used instruments from the high-quality line of General Electric laboratory and production measuring and test equipment. Many others are available and we invite your inquiries. For complete information write: *Electronics Department, General Electric, Syracuse, N. Y.*

Everything for Broadcasting and Electronics in Education

GENERAL ELECTRIC

(160-D6)

ALBERENE STONE CORPORATION OF VIRGINIA

Quarriers and Fabricators of Alberene Soapstone Serpentine and Tremolite

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ALBERENE SOAPSTONE

Natural quarried stone of medium hardness, blue-gray in color, produced and fabricated for more than 50 years; used in increasing quantities for:

Table Tops and Backs
Reagent Shelving
Fume Hoods, Gutters
Sinks, Drainboards
Tanks and Tank Linings
Toilet Partitions
Shower Compartments
Interior and Exterior Trim
Door and Window Sills
Fireplace Linings, Hearths
Spandrels

ALBERENE TREAD STOCK (GRADE 25)

Selected stone of extreme hardness, reserved exclusively for Stair Treads, Landings, Platforms, and Flooring. Tests show an abrasive hardness factor of 25-40, the highest durability factor on the National Bureau of Standards scale of any natural stone commercially used for these purposes. Its siliceous nature makes it non-slip wet or dry.

GRADE 25 ALBERENE

Variety of extremely hard stone, especially selected for laboratory working surfaces. Takes a permanent high sheen when rubbed down with oil. Abrasive hardness factor, 25-40, National Bureau of Standards tests.

ALBERENE BLACK SERPENTINE

This natural stone is becoming extremely popular. Its great resistance to weather action makes it especially desirable for exterior work. When sand-blasted (as in spandrels) the fine tracery of the designs stands out against the polished black surface. Abrasive hardness factor, 30-45, National Bureau of Standards tests.

ALBERENE TREMOLITE

An interesting addition to the line. Two varieties, one polishes to a dark green, the other to a dark blue. Abrasive hardness factor, 25-40, National Bureau of Standards tests.

PHYSICAL AND CHEMICAL PROPERTIES

All grades of Alberene Stone are homogeneous and finely granular in all directions, dense and non-stratified, chemically resistant, impervious and non-staining. Alberene soapstone is easily machined—bored, slotted, grooved, tongued, turned—without splitting or spalling.

LABORATORY FIXTURE CONSTRUCTION

Alberene laboratory fixtures are practically one piece structures of solid stone. Table top slabs are united by a practically invisible joint employing a strip of non-corrosive metal cemented in grooves, with abutting slab edges sealed with acid-proof cement. Fume hoods, sinks and tanks are assembled with tongue-and-groove joints held by hidden bolts and nuts and cemented—permanently gas and liquid tight.

SERVICE IN DESIGN AND INSTALLATION

Every laboratory of major importance equipped in the past 50 years has used Alberene soapstone wholly or in large part. If you have a war training course you will undoubtedly need additional equipment. Let us help. We have the experience and the facilities.

MANUFACTURING FACILITIES

Quarries and mills at Schuyler, Virginia, are the largest in the world devoted exclusively to the production and fabrication of special purpose stone.

Section of Chemical Engineering Laboratory, Rensselaer Polytechnic Institute, Troy, N. Y.

Alberene Stone Stair Treads and Platforms in Woodrow Wilson High School, Washington, D. C. Nathan C. Wyeth, Municipal Architect

GENERAL CERAMICS COMPANY

(CHEMICAL EQUIPMENT DIVISION)

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TORONTO, CANADA, Richardson Agencies Ltd., 454 King Street, West

SAN FRANCISCO, 598 Monadnock Building
SEATTLE, 1411 Fourth Avenue Building
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MONTREAL, CANADA, Canadian Cement Building
VANCOUVER, B. C., Willard Equipment Ltd., 860 Beach Avenue

Manufacturers of Acid-Proof Chemical Stoneware and Porcelain Laboratory Equipment

A complete line of acid-proof chemical stoneware and porcelain equipment for chemistry and physics laboratories in educational and research institutions for general industrial chemical purposes, and for hospitals, electroplating plants, newspapers, photo-engraving shops and other establishments where corrosive fluids are used. The line includes laboratory sinks, drain lines and fittings, sumps, fume ducts, pumps and ventilating fans.

A list of colleges and universities with chemical laboratories equipped with General Ceramics Chemical Stoneware and Porcelain is practically a roster of our leading institutions of learning. Installations have also been made in Walter Reed Hospital, Washington, Curtis Publishing Company in Philadelphia and New York, The Times Building and United States Assay Office.

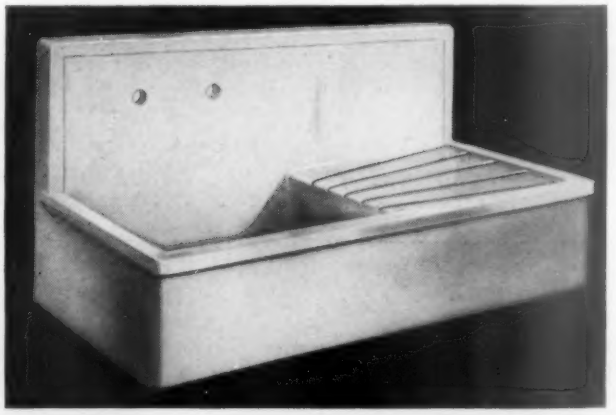
Chemical Stoneware

General Ceramics Chemical Stoneware is a dense granite-like material with an attractively glazed surface. Both the glaze and the body of the ware are completely impervious to all acids and other chemicals, excepting hydrofluoric acid. It is mechanically strong, leakproof, easy to clean and lasts indefinitely.

Laboratory sink with double drainboard in either Chemical Stoneware or Porcelain. Can be furnished without the integral back, with single drainboard and with details of construction as required

Cerawite Chemical Porcelain

Cerawite is a new chemical porcelain, completely vitrified, high fired, non-porous. Has greater mechanical strength and resistance to thermal shock than it has been possible heretofore to combine in one ceramic body. This corrosion resistant body withstands extremely stringent conditions.



Laboratory sink, Chemical Stoneware or Porcelain, with integral back and side. Can be furnished without back and side in various types and sizes as required

Engineering Service

We offer competent engineering service in the design of stoneware, porcelain or special chemical equipment and in the planning and layout of laboratories and in other buildings where corrosive products are handled. Bulletins on General Ceramics laboratory sinks and on acid-proof pipe and fittings will be furnished on request.

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Acid, Alkali and Corrosion Proof Chemical Stoneware

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314 Stephenson Bldg., Detroit, Mich.
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PRODUCTS

Acid Waste Pipe and Fittings
Acid-Proof Fume Ducts
One-Piece Laboratory Sinks
Acid-Proof Table Troughs
Neutralizing Sumps
Tanks, Jars, Filters, etc.

GUARANTEED SATISFACTORY — MAURICE A. KNIGHT — ACID-PROOF CHEMICAL STONEWARE
KNIGHT-WARE
"IT IS THE BODY ITSELF"

SOME INSTALLATIONS

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McGill University
Purdue University
Ohio State University
Brooklyn College
Princeton University
Northwestern University
University of Arkansas
University of California
University of Washington
University of West Virginia
Mellon Institute of Industrial Research

KNIGHT-WARE

Knight-Ware is an improved ceramic material that is dense, tough and wholly inert to the action of chemical solutions or gases, weak or strong, hot or cold (Hydrofluoric acid and hot caustic solutions excepted). Its acid-proof quality does not depend upon any glaze or surface treatment. "It is the body itself" that is entirely acid-proof. Knight-Ware equipment, properly installed, is trouble-free and permanent.

LABORATORY SINKS

Knight-Ware sinks are custom-made to specified measurements without extra cost. The one-piece construction, smooth surfaces, rounded corners and acid-proof quality mean a freedom from leaks and a cleanliness that is permanent. Splash backs, drainboards, aprons and outlets of several styles may be had as integral parts of the sink. Bottoms are sloped to insure complete drainage. The finish is a rich brown salt glaze that will not stain or peel.

ACID WASTE PIPE AND FITTINGS

Knight-Ware pipe and fittings are made in standard designs in any bore from 1 to 60 inches and straight lengths up to 5 feet. Special pieces to fit unusual places or to eliminate extra joints are available at low cost. Knight-Ware pipe is light in weight, strong and acid-proof.

Joints, packed and poured to our specifications, are tight and lasting.

KNIGHT-WARE FUME DUCTS

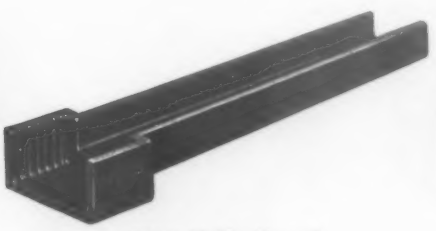
Ventilating pipe is available in round or rectangular shapes in bores up to 60 inches and with bell and spigot, flanged or plain butt end connections. Specify Knight-Ware for lasting protection.

SERVICE

If you are planning a new laboratory or modernizing your present one, we offer our knowledge and practical experience gained from scores of Knight-Ware installations.

Our fully illustrated Laboratory Equipment catalog will be sent upon request.

Fig. 237 RD Sink with right hand drainboard. Available with left hand or double drainboards and apron.



275A Table Trough

268 Knight-Ware S-Trap with Cleanout

LABORATORY FURNITURE COMPANY, INC.

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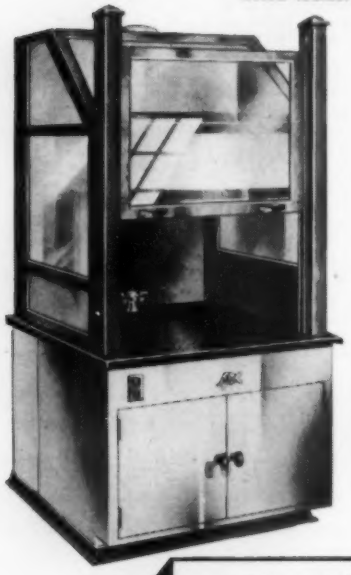
CHEMICAL FUME HOOD SH38C single sash, inclosed cabinet support.



INSTRUCTOR'S DESK No. 8250 recessed service fixtures.

NEW SCHOOL LABORATORY EQUIPMENT BUILT TO INDUSTRIAL LABORATORY SPECIFICATIONS

not an adaptation . . .

Feature by feature, every characteristic of STEELAB school laboratory equipment is 100% professional! It is made to precisely the same specifications as STEELAB industrial laboratory equipment, which has served through more than 20 years of peace and war, in America's outstanding laboratories.

STEELAB has over 10,000 installations on record *without* extensive repairs — *with* minimum maintenance.

Fireproof, permanent, almost indestructible STEELAB has been time-tested under extreme conditions, proving itself the most dependable value for your appropriation.

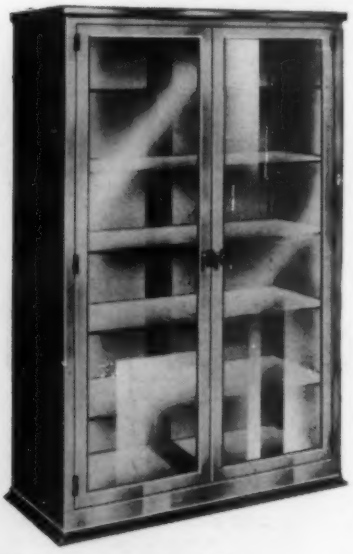
ENGINEERING SERVICE

Why not avail yourself of our Engineering Service which we will gladly furnish without obligation? This includes discussion of your problems, preparation of plans and specifications, and budget estimates.

Whether your problem is to plan a new project or add to the student accommodation of your present facilities our service will prove to be of valuable assistance.

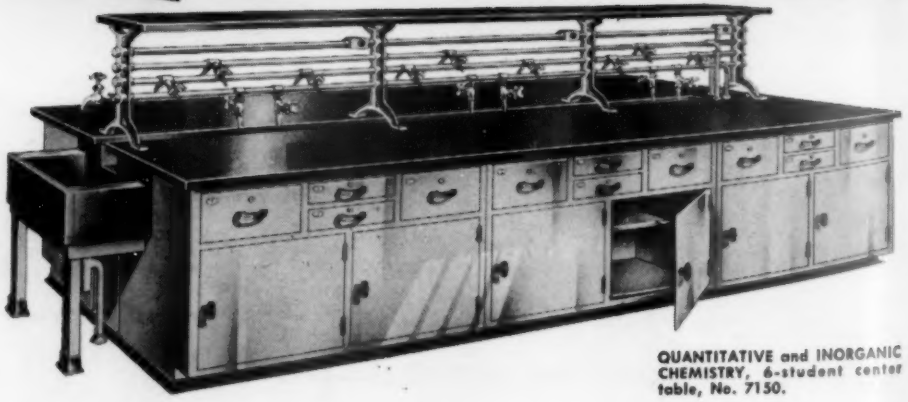
Products Manufactured

TABLES — *Science, Physics, Chemistry, Biology, Home Economics, Manual Arts, Geology, Lecture, Demonstration, Instructors, Balance, Dark Room Developing, Bacteriology, Microscope, Medical, Research, Private Laboratory.* **CASES AND CABINETS** — *Chemical, Apparatus, Instrument, Glassware, Microscope, Museum, Specimen, Acid Storage, Map and Chart.* **CHEMICAL FUME HOODS (OPEN AND CLOSED TYPES)** — *Air Conditioned, complete with exhaust fans and ducts. Also* **ACID-PROOF SINKS AND TANKS** *and* **SPECIAL LABORATORY FITTINGS AND ACCESSORIES.**



DISPLAY CABINET No. 8520, 5 full-size adjustable plate-glass shelves, fluorescent lighting.

SEND FOR FREE CATALOGUE AND MANUAL



QUANTITATIVE and INORGANIC CHEMISTRY, 6-student center table, No. 7150.

HARPER ELECTRIC FURNACE CORPORATION

1440 Buffalo Avenue • Niagara Falls, N. Y.

• SCHOOLS AND UNIVERSITIES are using Harper Electric Furnaces for practical training in high temperature heat treating, assaying, ceramic firing, sintering powdered metals and other high temperature work.

Harper
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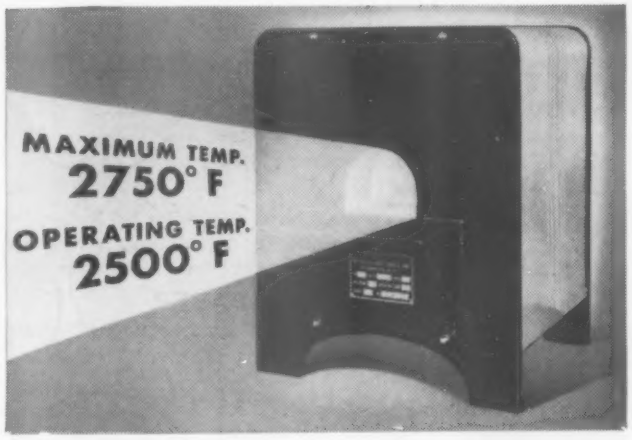
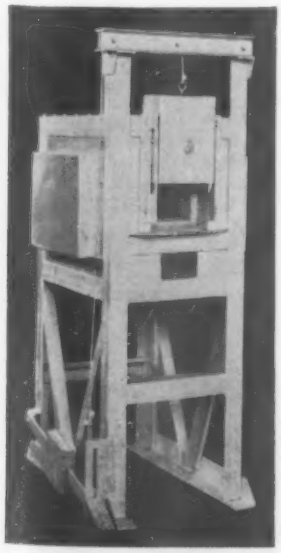
1924



LABORATORY FURNACES

Provide rapid heating to temperatures from 1500 degrees to 2750 degrees F. Uses include alloy, cement, and glass melting tests, dehydration and oxidation, calcining, preparing enamel frits, etc. Equipped with non-metallic heating elements, muffle and plug type doors.

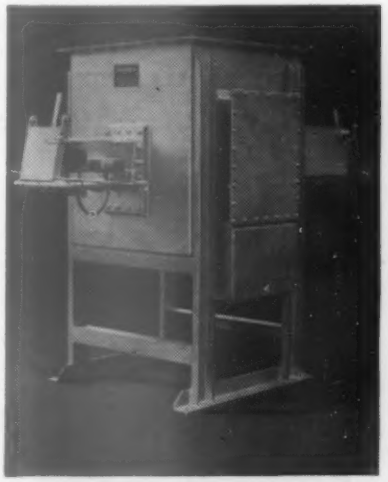


HEAT TREATING FURNACES

This general utility furnace gives temperatures up to 2750 degrees F., with non-metallic heating elements. Like all Harper Furnaces it provides uniform temperature distribution and control. Floor and bench models in various sizes.

CERAMIC KILNS

Schools offering courses in Ceramics are finding it advantageous to use the same Harper Electric Kilns that are used by industry. Accuracy of temperature distribution and control, to within plus or minus 2½ degrees and ability to handle difficult firing cycles are features.



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Eaton-Dikeman laboratory filter papers are sold by all laboratory supply dealers under their own special labels, as well as E & D labels. To be sure of obtaining E & D Quality, it is best to ask for the E & D label.

The qualitative grades are sixteen in number and are best described in our Descriptive Booklet No. 1, which we shall be glad to send you on request.

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Our NEW FILT analytical grades, which we developed sometime ago, have been used by chemists the world over, giving excellent results. They were created to replace the foreign single-acid washed papers to be used for any analytical procedure where a strictly double-acid washed paper is not necessary. They are made of the very highest quality of pure cotton fibre and are specially treated and processed to insure a high degree of purity and a low ash weight. The NEW FILT grades, Nos. 1, 3, and 4, have an ash weight the equivalent of any single-acid washed imported paper.

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- *Acid Oxalic, Cryst., Reagent, A. C. S.*
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- *Calcium Oxide, Powder, Reagent*
- *Carbon Disulfide, Reagent, A. C. S. and C. P.*
- *Carbon Tetrachloride, Reagent, A. C. S. and C. P.*
- *Cuprous Chloride, Powder, Reagent, A. C. S. and Tech.*
- *Ether, Anhydrous, Reagent, A. C. S.*
- *Filter Paper—Grade "O"*
- *Iodine, Resublimed, Reagent, A. C. S. and U. S. P.*
- *Magnesium Chloride, Cryst., Reagent, A. C. S.*
- *Manganous Sulfate, Monohydrate, Reagent, A. C. S.*
- *Mercury Metal, Redistilled, Reagent, A. C. S.*
- *Potassium Acetate, Cryst., Reagent and U. S. P.*
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- *Potassium Chloride, Cryst., Reagent, A. C. S.*
- *Potassium Cyanate, Cryst., Reagent and Purified*
- *Potassium Iodide, Cryst., Reagent, A. C. S. and U. S. P.*
- *Sodium Acetate, Cryst., Reagent, A. C. S.*
- *Sodium Carbonate, Anhydrous, Reagent, A. C. S.*
- *Sodium Fluoride, Powder, Reagent, A. C. S.*
- *Sodium Hydroxide, Chip, Reagent, A. C. S.*
- *Sodium Oxalate, Powder, Reagent, A. C. S.*
- *Sodium Thiosulfate Cryst., Reagent, A. C. S.*

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"REAGENT" GRADE: The highest grade available; products conforming to American Chemical Society specifications are marked "A. C. S." On reagents not covered by A. C. S. specifications, Baker & Adamson has established standards of purity for the individual products which will permit the use of these chemicals in the most exacting work. Maximum limits of allowable impurities are shown on the labels of products classified as "Reagent." These limits are very low; all materials shipped meet these uniform standards.

"C. P." GRADE: A few of the common chemicals are offered under the "C. P." designation. This quality, while not equal to the "Reagent" quality, is nevertheless suitable for many routine uses in educational and other laboratories.

"U. S. P." AND "N. F." GRADES: Products so marked conform to the requirements of the U. S. Pharmacopoeia and the National Formulary respectively.

"PURIFIED" AND "TECHNICAL" GRADES: For products so designated, care has been exercised to offer chemicals which are physically clean and of high quality, but not required to meet specifications of Reagent, C. P., U. S. P., or N. F. grades.

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A MICROSCOPE

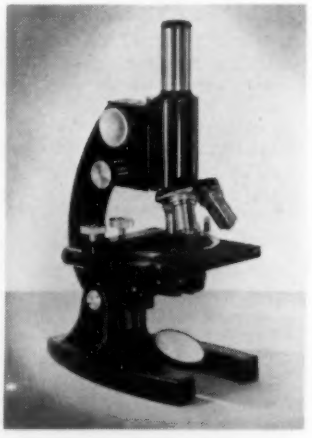
The Bausch & Lomb Model A Microscope is particularly recommended for use in elementary Botany, Zoology, and Biology classes in high school or college.

Its simple construction makes it the ideal instrument for the hard usage received in classroom service. Its optics are of the precision type.

Its features include the following: Vertical Monocular Body. Standard B&L rack and pinion coarse adjustment with patented lever type side fine adjustment. Designed to take spiral focusing sleeve substage adapting it to use with oil immersion objectives and making possible complete utilization of the full optical capabilities of the lower and intermediate power objectives. Revolving, dustproof nosepiece, centered and parfocalized at the factory.

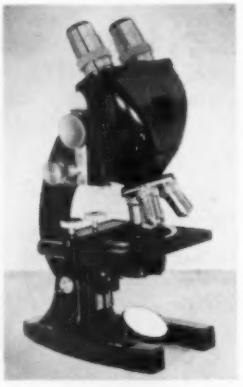
Optical Equipment: Achromatic Objectives, 10X (16 mm) 0.25 N.A. and 43X (4 mm) 0.65 N.A. Double Nosepiece—Huygenian Eyepieces 5X and 10X. Cat. No. 31-21-40-04.

BA MICROSCOPE



The Bausch & Lomb Model BA Microscope is similar to the Model A but is equipped for more advanced work. A standard instrument in many hospital and professional laboratories, and a basic model in industrial and commercial laboratories, it is not only an ideal instrument for the teaching of microscopy, but it also familiarizes the student with the instrument he will be called upon to use in later professional or business life. Features include a built-on mechanical stage which holds slides 50 x 75 mm, permitting scanning of entire area, rack and pinion substage with Abbe Condenser 1.25 N.A. in full ring mount, complete adaptability to a wide range of accessories.

Optical Equipment: Achromatic Objectives, 10X (16 mm) 0.25 N.A. 43X (4 mm) 0.65 N.A. and 97X (1.8 mm) Oil Immersion 1.25 N.A. Triple Nosepiece—Huygenian Eyepieces 5X and 10X, Abbe Condenser 1.25 N.A. Cat. No. 31-21-55-08.



CTA MICROSCOPE

This microscope is especially adapted for advanced Biological work, for Medical Study and Diagnosis and as a general purpose microscope in universities. Has 30° inclined binocular body (interchangeable with monocular tube for photomicrography) with parallel eyepiece tubes. Built-on mechanical stage holds slides 50 x 75 mm, permitting examination of the entire area. Abbe Condenser 1.25 N.A. in full ring mount is in rack and pinion substage. Revolving, dustproof nosepiece, centered and parfocalized at the factory. Optical equipment of uniform high excellence includes achromatic and fluorite objectives.

Optical Equipment: Achromatic Objectives, 10X (16 mm) 0.25 N.A., 43X (4 mm) 0.65 N.A. and 97X (1.8 mm) Oil Immersion 1.25 N.A. Triple Nosepiece—Huygenian Eyepieces 5X and 10X, Abbe Condenser 1.25 N.A. Cat. No. 31-21-88-08.

CSA MICROSCOPE

This Bausch & Lomb Microscope is regularly equipped with a removable vertical monocular body and may be converted into a vertical binocular microscope (CBA) or an inclined binocular microscope (CTA) by the addition of the vertical or inclined binocular eyepiece body tube without special factory fitting. Mechanical features are otherwise the same as the Model CTA, including built-on mechanical stage, Abbe Condenser in full ring mount in rack and pinion substage, and revolving, dustproof nosepiece, centered and parfocalized at the factory.

Optical Equipment: Achromatic Objectives, 10X (16 mm) 0.25 N.A., 43X (4 mm) 0.65 N.A. and 97X (1.8 mm) Oil Immersion 1.25 N.A. Triple Nosepiece—Huygenian Eyepieces 5X and 10X, Abbe Condenser 1.25 N.A. Cat. No. 31-21-86-08.

KW TYPE STEREOSCOPIC MICROSCOPE

The great popularity of the KW Type Stereoscopic Microscopes has prompted us to offer them for use in schools and universities. Their range of magnifications, from 7X to 150X, especially suits them for biological and paleontological work. An interesting feature of this series is the patented vertically revolving drum nosepiece, holding three pairs of parfocal objectives in readiness to be swung instantly into place. This microscope gives stereoscopic, three dimensional effect. Image is upright and unreversed in exactly the same position it would be seen by the naked eye. Exceptionally wide field.

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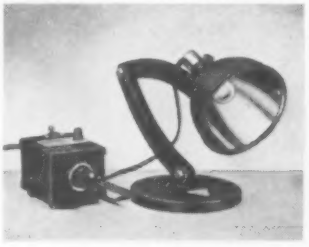
B&L REFLECTOR LAMP



This lamp fills a definite need in work with both the monocular or binocular mon-objective microscope and the stereoscopic wide field microscopes. Elliptical mirror reflector with adjustment provides diverging, parallel or converging light.

Jointed arm mounting permits all-angle illumination above or below stage. With adjustable transformer, light intensity can be exactly fitted to the work in hand.

OTHER MICROSCOPE LAMPS

Other B&L Microscope Lamps are available for various purposes in the school laboratory. The two shown are the B&L Universal Microscope Lamp and the B&L Substage Lamp.

B&L MICROTOMES

B&L offers a complete line of Microtomes. The Improved Clinical Microtome (illustrated) provides several desirable and exclusive operating advantages. It is a practical laboratory instrument, fitted for rapid and accurate sectioning of frozen, celloidin and paraffin material. Knife travel and feed are automatic, both being driven by a balanced handwheel of sufficient mass to insure smooth action on all material and section thicknesses of 5 to 75 microns in steps of 5 microns. Catalog D-16 describes the complete line.

B&L SPECTROGRAPHS

The complete B&L line of Spectrographic Equipment covers every need. Models range from the Bunsen Spectroscope (illustrated) for elementary class room work to the Large Littrow Spectrograph for examining complex alloys. Each is designed and built with the utmost care and due to our great experience in this field represents all of the best features necessary for both teaching and laboratory research. Catalogs D-26 and D-20 give complete details.

B&L MAGNIFIERS

Of great usefulness in the school laboratory, Bausch & Lomb Hastings Triplet Magnifiers are highly corrected for spherical and chromatic aberration, and have a wide angle of view as well. Magnifications available range from 7X to 20X. Other types of magnifiers for various purposes are available. Catalog I-15.

SEND FOR CATALOGS

For complete information on Laboratory Microscopes and Accessories send for Catalogs D-185 and D-184. For information on Research Microscopes ask for Catalog D-173. For information on B&L Balopticons see pages 430, 431 this catalog. Remember the instruments listed on these pages are but a small part of the B&L Line. If you have need for information on any optical products, Bausch & Lomb will gladly be of service to you.

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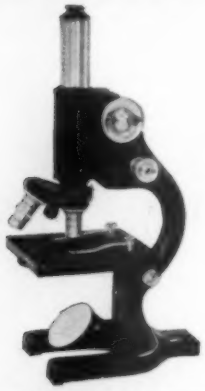
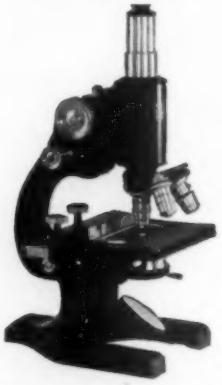
SPENCER LABORATORY MICROSCOPE NO. 66



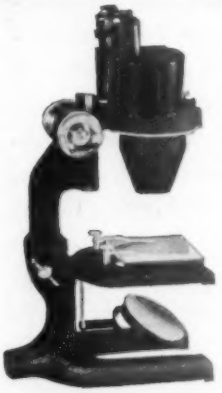
The Spencer No. 66 Microscope is particularly suited for student use in the biology laboratory. It is a standard size instrument with the same high quality optical equipment and mechanical features as on more expensive microscopes. It is equipped with a rack and pinion coarse adjustment, micrometer screw type fine adjustment, durable Bakelite stage, 110mm. x 115mm., and a dual-cone revolving nosepiece. The illumination is controlled by the revolving disc diaphragm and concave mirror. A substage condenser cannot be supplied with this instrument. The microscope is finished in satin black enamel and chromium plating.

SPENCER NO. 33MH MICROSCOPE



The adaptability of the No. 33MH Microscope makes it particularly suitable for standard laboratory work in schools. The optical system consists of 16mm., 4mm. and 1.8mm. (oil immersion) objectives, 6X and 10X eyepieces and an Abbe N. A. 1.25 substage condenser. Mechanical equipment includes rack and pinion coarse adjustment, micrometer screw type fine adjustment, fork-type substage and a built-on mechanical stage. The instrument is finished in durable black enamel and chromium plating.

SPENCER JUNIOR STEREOSCOPIC MICROSCOPE



The Spencer Junior Stereoscopic Microscope No. 57 is a moderately priced, adaptable instrument designed for classroom work. It is particularly valuable for the examination and study of flowers, plants, molds, rocks and other such material so interesting in the early approach to science. The microscope is supplied with a detachable mirror and horseshoe base for use with transmitted light. It can be purchased with a single pair of objectives or two pairs of objectives in a revolving objective holder. Optical equipment is available to provide a range of magnifications from 8.1 to 70.8.

SPENCER ADJUSTABLE LABORATORY LAMP NO. 370

The Spencer No. 370 Lamp may be used for all general illumination, dark field work and photomicrography. The large base and vertical column give sufficient support to maintain rigidity. An iris diaphragm with graduations controls the size of the illuminated field of the microscope.

SPENCER SUBSTAGE LAMP NO. 385

The Spencer Substage Lamp No. 385 is small, compact and provides excellent illumination for average work with the microscope. Made of Bakelite, it is capable of withstanding the continuous hard usage in a laboratory.

SPENCER SPECTROMETER

The Spencer Graduated Circle Spectrometer is particularly useful in the school laboratory. It is a sturdy, adaptable instrument which, with various accessories, would constitute much of the laboratory equipment needed in the study of optics. Some of the experiments possible with this instrument include examining the spectrum, measuring angles, determining wave length and measuring refractive index. The Spectrometer is finished in durable black enamel with chromium plating.

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MEASURING INSTRUMENTS FOR RESEARCH, TEACHING AND TESTING

Adapted, with a high degree of exactness, to the latest needs of the research scientist, of the student and of the man who makes routine tests in laboratory, plant or field, is the wide variety of apparatus briefly listed in the following pages.* Usually, there will be found a choice of instruments and their accessories: for high or moderate precision; for table use or portable; for general use or specialized. In some, all components are self-contained. Others are separate units which can be combined to form various assemblies. In all, we endeavor to embody sound measuring principles in constructions of genuine merit, to keep designs in advance of demands for operating convenience, to use suitable materials assembled by skilled craftsmen.

Almost invariably, adjustments of L&N instruments prove better than our guarantees. Realizing that nothing is permanent and that the best of standards are not absolute, we make our claims conservatively. Our objective is so to proportion accuracy, sensitivity and readability in every instrument which bears the L&N insignia, and to build it so well, that its owner can have complete confidence in every measurement made within error limits which are definitely specified. This is an objective which our executives and workers have joined in holding conspicuously before them for over forty years . . . during which the extensive and ever-widening contacts we have had with both science and industry have helped us to advance progressively in the art of instrument making. In recent years, the application of scientific principles to an extensive line of instruments adapted to the more rugged conditions of industry, has enabled us to equip, staff and qualify more thoroughly than ever to carry forward the fundamental instrument arts in step with the growing demands of science.

INDUSTRIAL-TYPE EQUIPMENTS SOLVE MANY LABORATORY PROBLEMS

Industrial-type instruments and furnaces (not listed here) have many uses in the laboratory. Micromax recorders calibrated to read directly in temperature, pH or other units provide continuous chart records of test runs. Sometimes, recorders which control automatically, or even non-recording controllers, are used. Industrial-type indicators, especially portable models, are often used for a variety of measurements; optical pyrometers, for high temperatures. In metallurgical laboratories, the smaller sizes of Hump and Homo electric heat-treating furnaces are used for hardening, carburizing, nitriding, tempering and annealing.

RESISTORS · INDUCTORS · CAPACITORS · STANDARD CELLS

For use as reference or working standards in d-c and a-c bridge measurements, we offer a wide choice of fixed and adjustable standards—resistors, inductors, capacitors—and standard (potential) cells. Usually, you will find listed the ones needed to cover any desired range

Each L&N standard is a convenient unit which can be depended upon to retain its stated precision. Because the properties of resistance materials, dielectrics, etc. are not invariable, and even the best standards are not absolute, a margin is allowed between accuracy of adjustment and that guaranteed. To assure reliability, only that accuracy is claimed which a given standard can be expected to maintain, in normal use, for a long period.

RESISTORS: You'll find both fixed resistors and adjustable resistance boxes—some primarily for direct current, others specially designed for alternating current. Many are available in a choice of resistance values.

INDUCTORS: For use as standards of inductance in a-c bridge measurements up to 1000 cycles, we list on pages 4 and 5 a choice of fixed and adjustable inductors.

The fixed inductors listed are toroidal coils, mounted on bakelite plates, enclosed in ventilated cases. Up to 1000 cycles, these inductors are practically immune from stray-field errors, cause no objectionable external fields, and show no appreciable increase in resistance.

For varying self inductance of a circuit, or mutual inductance between two circuits, we list Brooks Inductometers. Standard instruments have self-inductance scales only.

CAPACITORS: Both mica and air capacitors are available in a choice of fixed and adjustable models. Due to improved mechanical switching arrangements, both air and mica capacitors suitable for use at carrier frequencies are available, and two of the air capacitors listed (1187 and 1188) can be used at frequencies of a few megacycles

STANDARD (POTENTIAL) CELLS: Here listed are the standard cells we recommend for use with Potentiometers (page 6) which require an external cell.

For measurements at either high or moderate precision, we recommend the 7308 Eppley Standard Cell for use with the several null potentiometers listed; the 7309 Low Resistance Cell, for use with Brooks Deflection Potentiometers. Each is supplied with a certificate issued by the Eppley Laboratories. The 7310 Cell should be used only for work where relatively low precision is acceptable.

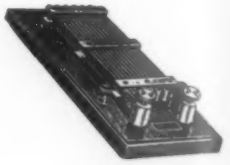
* Prices listed may of course be changed without notice. Formal quotations, made on request, are always good for 30 days.
Jrl. Ad E(27)

4210
(about ⅛ actual size)

4020, 25, 30, 35, 40
(about ⅐ actual size)

4221, 4222 is similar
(about ⅛ actual size)

4223
(about ⅛ actual size)



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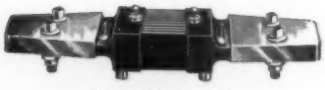

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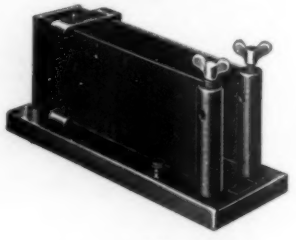

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4205–09
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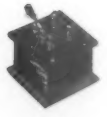

4245
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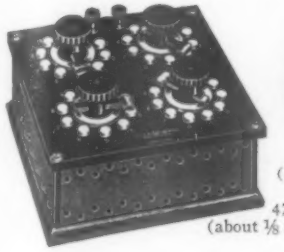
FIXED D-C RESISTORS

Instrument	List Number	Resistance, Ohms	Current Rating, Amperes	Limit of Error	Price	Refer to Catalog
One-Ohm Standard Resistor (A primary standard of resistance which establishes a new order of stability.)	4210	1 Nominal	0.1	N.B.S. Certificate required giving value ±0.0001% in terms of ohm maintained by National Bureau of Standards.	$100.00	E-53 E
National Bureau of Standards Type Resistors (For use as primary standards of resistance.)	4020	1	0.3	±0.01%	20.00	E-53 E
			1	±0.04%		
	4025	10	0.1	±0.01%	20.00	
			0.3	±0.04%		
	4030	100	0.03	±0.01%	20.00	
			0.1	±0.04%		
	4035	1000	0.01	±0.01%	20.00	
			0.03	±0.04%		
	4040	10,000	0.003	±0.01%	25.00	
			0.01	±0.04%		
Reichsanstalt Type Resistors (For use in accurate measurement of current with a potentiometer, and as standards of comparison in low-resistance measurements.)	4221	0.1	3*	±0.02%	50.00	E-53 E
			10*	±0.05%		
	4222	0.01	10*	±0.02%	55.00	
			30*	±0.05%		
	4223	0.001	30*	±0.02%	120.00	
			100*	±0.05%		
Resistors (Shunts) for Large Currents (Primarily for accurate measurement of large currents with potentiometers, and as standards for comparison in low-resistance measurements.)	4360	0.1	15	±0.04% when cooled by air at ordinary room temperature.	55.00	E-53 E
	4361	0.01	100		100.00	
	4363	0.001	300		90.00	
	4364	0.001	500		175.00	
	4369	0.00004	1500		187.00	
	4372	0.00002	2000		187.00	
	4375	0.00001	3000		300.00	
Secondary Resistance Standards (Working standard of moderate accuracy.)	4205	1	1.0	±0.1%	10.00	E
	4206	10	0.3		10.00	
	4207	100	0.01		10.00	
	4208	1000	0.003		10.00	
	4209	10,000	0.001		10.00	
Tenth-Megohm Resistance Box (A high-resistance standard with short-circuiting switch.)	4245	100,000	0.007	±0.1%	50.00	E-53 E

* Maximum current assumes operation in stirred oil bath.


4716
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4775–76
(about ⅛ actual size)

4252
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4244
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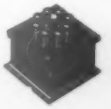
4246
(about 1/16 actual size)


4247
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4640
(about ⅛ actual size)

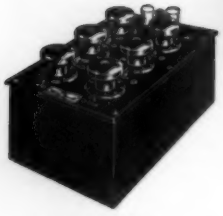
ADJUSTABLE D-C RESISTORS

Instrument	List Number	Resistance, Ohms	Decade Steps	Current Rating, Amperes: When Highest Decade in Use is	Current	Limit of Error	Price	Refer to Catalog
Open-Dial-Switch Resistance Boxes (For d-c measurements. Combine high precision, speed and convenience.)	4710	100	10x0.1+9(1+10)			Resistance change from zero setting, measured across binding posts, equals dial settings ±(0.05%+0.005Ω).*	$ 75.00	
	4711	1000	10x1+9(10+100)				70.00	
	4712	10,000	10x10+9(100+1000)	0.1	2.2		80.00	E-53
	4715	1000	10x0.1+9(1+10+100)	1.0	0.7		95.00	E
	4716	10,000	10x1+9(10+100+1000)	10.0	0.22		100.00	
	4720	10,000	10x0.1+9(1+10+100+1000)	100.0 1,000.0	0.07 0.022		125.00	
Enclosed-Switch Resistance Boxes (Popular, inexpensive standards of moderate precision. Suitable for d-c and up to 1000 cycles a-c.)	4770	99	9(1+10)	When Highest Decade in Use is	Current	Resistance change from zero setting, measured across binding posts, equals dial settings ±(0.1%+0.01Ω).*	21.00	
	4771	990	9(10+100)				21.00	
	4772	9900	9(100+1000)				21.00	E-53
	4773	999	9(1+10+100)	0.1	1.6		28.00	E
	4774	9990	9(10+100+1000)	1.0	0.5		29.00	
	4775	9999	9(1+10+100+1000)	10.0 100.0	0.16 0.05		35.00	
	4776	999.9	9(0.1+1+10+100)	1000.0	0.016		35.00	
Post-Office Pattern Resistance Box (Popular for instruction.)	4252	11,110	Resistors: 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300, 400, 1000, 2000, 3000, 4000Ω.	Equals $\sqrt{1/R}$ where R is highest value resistor in use.		Resistance change from zero setting, measured across binding posts, equals plug readings ±(0.1%+0.01Ω).*	36.00	E-53 E
Post-Office Pattern Resistance Box (Similar to 4252, but lower total resistance.)	4254	1110	Resistors: 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300, 400Ω.	Equals $\sqrt{1/R}$ where R is highest value resistor in use.		Resistance change from zero setting, measured across binding posts, equals plug readings ±(0.1%+0.01Ω).*	30.00	E-53 E
Megohm Resistance Box (A high-resistance standard in 6 sections which can be used independently or in different combinations.)	4244	1,000,000	Subdivided 4 x 200,000 + 2 x 100,000Ω.	0.002		±0.1%	200.00	E-53 E
Tenth-Megohm Resistance Box (A high-resistance standard in 4 sections which can be used independently or in different combinations.)	4246	100,000	Subdivided: 10,000 + 20,000 + 30,000 + 40,000Ω.	0.005		±0.1%	90.00	E-53 E
Tenth-Megohm Resistance Box (Similar to 4246, but terminals of sections connected to binding posts on insulating pillars on top plate, and links used for connection between posts.)	4247	100,000	Subdivided: 10,000 + 20,000 + 30,000 + 40,000Ω.	0.005		±0.1%	65.00	E-53 E

* Statement assumes that box has been in regular use, or that dials will be rotated or plugs twisted in their blocks before box is put in use after a period of idleness. D-C resistance, with all dials or plugs at zero, does not exceed 0.03Ω.

FIXED A-C RESISTORS

Instrument	List Number	D-C Resistance, Ohms	Reactive Component	Current Rating, Amperes	Limit of Error	Price	Refer to Catalog
Secondary-Standard A-C Resistors (Working standards for a-c measurements.)	4631	1000	1 μh for 1000Ω standard to 2.5 μμf for 20,000Ω standard. Change of residual, less than 5% for frequencies up to 50 kc.	0.031	In d-c resistance: +0.1%. Difference between a-c and d-c resistance less than ±0.001% at 1 kc, ± 0.01 % up to 50 kc.	$13.00	E-53
	4632	2000		0.022		13.00	E
	4633	3000		0.018		14.00	
	4634	4000		0.016		14.00	
	4640	10,000		0.01		15.00	
	4642	20,000		0.007		17.00	



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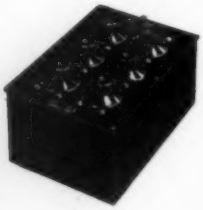

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4747–48
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4745–46
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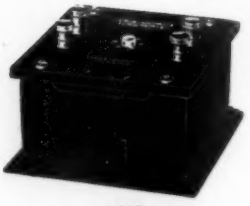

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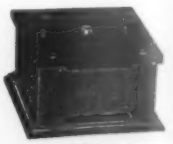

1530
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ADJUSTABLE A-C RESISTORS

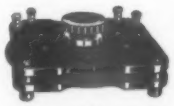
Instrument	List Number	Total Resistance, Ohms	Decade Steps*	Maximum Change of Inductance (or Capacitance) When Setting of Indicated Decade is Changed						Inductance for Zero Setting μh	Capacitance for 10,000 Ohm Setting μμf	Current Rating, Amperes		Limit of Error D-C Resistance Change Across Binding Posts Equals the Reading of the Dials:	Price	Refer to Catalog
				0.01 Ohm Decade μh	0.1 Ohm Decade μh	1.0 Ohm Decade μh	10 Ohm Decade μh	100 Ohm Decade μh	1000 Ohm Decade μμf							
A-C Resistance Boxes (Adjustable standards of sturdy permanent construction for precise measurements with a-c bridges. 4765 and 4764 for very low; others for moderately low inductance and capacitance changes.)	4764 Shielded	11,111.1	10(0.01+0.1+1+10+100+1000)	0.003	0.006	0.02	0.5	15.0	5.0	1.5	10.0	Equals $\frac{0.5}{\sqrt{R}}$ where R is highest setting of highest decade in use.		±(0.05% +0.005 ohm)**	$300.00	E-53 E
	4765 Shielded	11,111.1	10(0.01+0.1+1+10+100+1000)	0.01	0.02	0.05	0.5	15.0	5.0	1.5	10.0			±(0.05% +0.005 ohm)**	270.00	
	4750 Shielded	11,111.1	10(0.01+0.1+1+10+100+1000)	0.02	0.2	0.5	1.0	25.0	7.0	0.7	15.0	When Highest Decade in Use is:	Current	±(0.05% +0.005 ohm)**	100.00	
												1	0.5			
												10	0.11			
												100	0.35			
												1000	0.011			
	4749 Shielded	11,111.1	10(0.01+0.1+1+10+100+1000)	0.02	0.2	0.5	1.0	25.0	7.0	0.7	15.0	1	0.5	±(0.1% +0.01 ohm)**	90.00	
												10	0.16			
												100	0.05			
												1000	0.016			
	4748 Shielded	11,110	10(1+10+100+1000)	Lowest dial 1 ohm		0.5	1.0	25.0	7.0	0.4	15.0	Same as 4750		±(0.05% +0.005 ohm)**	65.00	
	4747 Shielded	11,110	10(1+10+100+1000)	Lowest dial 1 ohm		0.5	1.0	25.0	7.0	0.4	15.0	Same as 4749		±(0.1% +0.01 ohm)**	55.00	
	4746 Unshielded	11,110	10(1+10+100+1000)	Lowest dial 1 ohm		0.5	1.0	10.0	5.0	0.4	10.0	Same as 4750		±(0.05% +0.005 ohm)**	60.00	
	4745 Unshielded	11,110	10(1+10+100+1000)	Lowest dial 1 ohm		0.5	1.0	10.0	5.0	0.4	10.0	Same as 4749		±(0.1% +0.01 ohm)**	50.00	

* In 4745-4750 the lowest decade may be removed and a 10,000 ohm decade incorporated for an additional price of $25.00.

** Statements of d-c resistance change assume that boxes have been in regular use, or that dials will be rotated before a box is put in use after a period of idleness. D-C resistance, with all dials at zero, does not exceed: 0.03 ohm for 4745 to 4748 inclusive, and for 4764 and 4765; 0.04 ohm for 4749 and 4750.

FIXED INDUCTORS

Instrument	List Number	Inductance, Millihenrys	Continuous Current Capacity, Amperes	Limits of Error at Frequency of 1000 Cycles:	Time Constant Approximate $\left(\frac{L}{R}\right)$	Price	Refer to Catalog
Standards of Self Inductance (Fixed Inductor)	1530	1	1	±1%	1×10^{-3}	$30.00	E
	1531	10	0.5	±0.2%	1×10^{-3}	30.00	
	1532	100	0.15	±0.2%	1×10^{-3}	30.00	
	1533	1000	0.05	±0.2%	1×10^{-3}	30.00	
Standard of Mutual Inductance (Fixed Inductor)	1540	50	0.15	±0.5%	5×10^{-4}	40.00	E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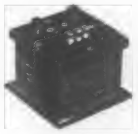
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1058
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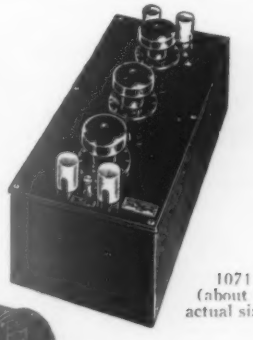
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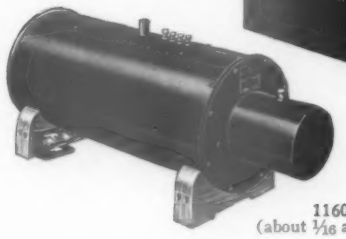
1160–61
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ADJUSTABLE INDUCTORS

Instrument	List Number	Inductance, Millihenrys	Continuous Current Capacity, Amperes	Limits of Error at Frequency of 1000 Cycles	Time Constant Approximate $\left(\frac{L}{R}\right)$	Price	Refer to Catalog
Brooks Inductometer (Adjustable, self-inductance range)	1520-A	1.5 to 12	1	±0.3%	2×10^{-3}	$150.00	E
	1520-B	12 to 100	0.35	±0.3%	2×10^{-3}	150.00	
	1520-C	100 to 800	0.1	±0.3%	2×10^{-3}	150.00	
	1520-D	0.8 to 6 henrys	0.03	±0.9% Calibrated at 60 cycles only	2×10^{-3}	150.00	
	1520-X	Special Range				On request	

CAPACITORS

Instrument	List Number	Capacitance	Decade Steps	Limits of Error	Price	Refer to Catalog
Fixed Mica Capacitor (For high precision)	1056	0.5 μf.*		±0.25%	$ 30.00	E
Adjustable Mica Capacitor (For high precision)	1061	1 μf in eight sections.*	0.5, 0.2, 0.1, 0.1, 0.05, 0.02, 0.02, 0.01 μf.	±0.25% in each section.	200.00	E
Adjustable Mica Capacitor (For high precision)	1058	1 μf in five sections.*	0.5, 0.2, 0.2, 0.05, 0.05 μf.	±0.25% in each section.	65.00	E
Three-Dial Shielded Mica Capacitor (Precision type for measurements at higher frequencies)	1071	1.11 μf.*	10(0.001 + 0.01 + 0.1)	Measured from binding posts, at 1000 cycles, capacitance difference between each setting of each dial and its zero setting (other dials on zero) agrees with nominal value of that setting to ±(0.1% + 0.5 μμf.)	325.00	E
Three-Dial Mica Capacitor (For moderate precision)	1070	1 μf.*	9(0.001 + 0.01 + 0.1). Extra 0.001 μf unit controlled by knife switch.	Same as 1071, except to ±(0.25% +15 μμf).	175.00	E
Adjustable Two-Terminal Air Capacitor (For high-precision measurements of low capacitance. Quartz insulators)	1188	Minimum 50 μμf. Maximum 1300 μμf.	Calibration based on zero setting of 100 μμf. 12 × 100 + continuously adjustable dial −50 to +100 μμf.	±1 μμf.	170.00	E
Adjustable Two-Terminal Air Capacitor (Similar to 1188 except has isolantite insulators)	1187	Minimum 50 μμf. Maximum 1300 μμf.	Calibrations based on zero setting of 100 μμf. 12 × 100 + continuously adjustable dial −50 to +100 μμf.	±1 μμf.	150.00	E
Adjustable Air Capacitor (For ordinary capacitance measurements)	1185	Range 40 to 1100 μμf.	Scale 0 to 100 uniform divisions.		30.00	E
Adjustable Air Capacitor (For balancing out residual capacitance in bridge assemblies)	1181	Range approximately 8 to 120 μμf.	Not calibrated.		19.00	E
Adjustable Air Capacitor (Similar to 1181 except for range)	1183	Range approximately 18 to 500 μμf.	Not calibrated.		21.00	E

*All mica capacitors may be operated continuously on 350 volts rms, 60 cycles.

CAPACITORS (Cont'd.)

Instrument	List Number	Maximum Potential Rating	Nominal Value	Limits of Error	Price	Refer to Catalog
Cylindrical-Type Shielded Fixed Air Capacitors	1160	10,000 volts at 60 cycles.	100 μμf within 2%.	Actual capacitance ±0.2% engraved on nameplate.	$575.00	E
	1161	25,000 volts at 60 cycles.	100 μμf within 2%.		775.00	E

STANDARD CELLS

Instrument	List Number	Internal Resistance	EMF at 20 C	Limits of Error	Price	Refer to Catalog
Unsaturated Standard Cells	7308	Not over 500 ohms.	1.0185 to 1.0195 volts.	±0.01% of certified value.	$20.00	E
	7309	Not over 100 ohms.	1.0185 to 1.0195 volts.	±0.01% of certified value.	25.00	E
	7310	Not over 500 ohms.	1.018 volts.	±0.1% at 20 C.	12.00	E

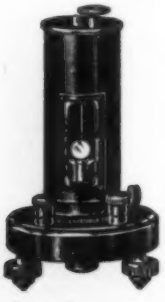
GALVANOMETERS AND DYNAMOMETERS

Here, briefly presented, is the L&N line of galvanometers and dynamometers—d-c galvanometers, both moving-coil and moving-magnet types; a-c galvanometers; and astatic dynamometers.

Practically the entire range of applications for galvanometers and dynamometers is covered by the standard instruments we list. Among them, you can almost always find the one you need for use as a balance-point detector in potentiometer or bridge measurements, or for calibrated deflection measurements. Usually, the system is an easily interchangeable unit, so that one galvanometer with extra systems can be made to serve for a wide range of measurements. Galvanometers having characteristics other than those specified herein, can be supplied. State characteristics you desire—such as period, sensitivity, critical damping resistance—in the order of their importance. In most cases, special characteristics can be obtained with standard parts, and the cost of the instrument will be little more than for listed galvanometers of the same type.

If you wish a more complete discussion of galvanometer characteristics and an explanation of fundamental principles underlying the construction and use of these instruments, we will gladly send you, on request, a copy of our 48-page, pocket-size Note Book ED(1) *Notes on Moving-Coil Galvanometers.*

D-C MOVING COIL GALVANOMETERS



2285 shown
2290, 2284, 2500,
2255 are similar
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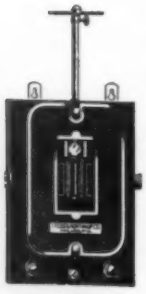

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actual size)

2420
(about 1/6 actual size)

Instrument	List Number	Sensitivity*** (Per mm at 1 meter or per scale Division)	Period (Sec.)	Resistance (Ohms) External Critical Damping	Resistance (Ohms) Coil	Price	Refer to Catalog
Type HS Reflecting Galvanometer (For extra high current sensitivity)	2290	0.00001 μa	40	100,000	800	$150.00	ED
Type HS Reflecting Galvanometer (Extra high voltage sensitivity)	2284-a	0.5 μv	1.5	40	21	115.00	ED
	2284-b	0.05 μv	7	10	16	115.00	ED
	2284-c	0.1 μv	5	20	15	115.00	ED
	2284-d	0.1 μv	5	50	25	115.00	ED
	2284-x	(as specified)					
Type HS Reflecting Galvanometer (Very high sensitivity)	2285-a	0.1 μv	7.5	25	17	100.00	ED
	2285-b	0.2 μv	5	40	16	100.00	ED
	2285-d	0.0003 μq	27	40,000	700	115.00	ED
	2285-e	0.003 μq	25	500	12	115.00*	ED
	2285-f	0.00004 μa	20	70,000	800	100.00*	ED
	2285-g	0.0003 μa	7	10,000	500	100.00	ED
	2285-h	0.008 μa	1.5	2,500	500	100.00	
	2285-x	(as specified)				115.00	
Type R Reflecting Galvanometer (For high sensitivity in general use)	2500-a	0.5 μv	5	50	12	60.00	ED
	2500-b	0.0005 μa	6	10,000	500	60.00	ED
	2500-c	0.005 μa	5	300	40	60.00	ED
	2500-e	0.003 μa	3	2,200	500	60.00	ED
	2500-f	0.0001 μa	14	22,000	500	60.00	ED
	2500-g	0.0005 μa	6	7,000	500	60.00	ED
Type P Galvanometer (For moderate sensitivity in general use. Widely used in educational laboratories. Easy to mount and handle)	2239-a	0.014 μa	8	10,000 to 100,000	115	25.00	ED
	2239-b	0.001 μa	14	10,000 to 25,000	1,000	25.00	ED
	2239-f	0.0002 μa	18	46,000	8,000	45.00	ED
	2239-c	1.5 μv	12	165	35	25.00	ED
	2239-d	0.002 μq	26	10,000	2,000	35.00	ED
	2239-e	0.011 μq	24	230	60	35.00*	ED
Galvanometer with Enclosed Lamp and Scale (For moderately high sensitivity)	2420-a	0.04 μa	3	10,000	300	40.00	ED
	2420-d	0.04 μa	3	2,000	300	40.00	ED
	2420-b	25. μv	3	80	23	40.00	ED
	2420-c	0.025 μa	3	15,000	1,000	40.00	ED
Marine Galvanometer (For high sensitivity in use on shipboard)	2255	0.02 μa	2	100,000	270	250.00	ED

* Price includes external resistor for critical damping.
*** Sensitivities are at least as high as stated; other characteristics within 20%. Microvolt sensitivities are for critical damping resistance in series. Coil resistances include suspensions.

GALVANOMETERS (Cont'd.)

nstrument	List Number	Sensitivity*** (Per mm at 1 meter or per scale Division)	Period (Sec.)	Resistance (Ohms)		Price	Refer to Catalog
				External Critical Damping	Coil		
Lecture Table Galvanometer (Specialized for demonstration purposes)	2260-a	0.1 μa	2	50	22	$ 75.00	ED
	2260-b	0.05 μa	2	200	100	75.00	ED
	2260-c	0.01 μa	2	5,000	1,350	75.00	ED
Pointer Galvanometer—45 degree scale (Combines sensitivity and convenience)	2310-a	2 μa	2.5	20	12	25.00	ED
	2310-e	1 μa	4.5	30	16	25.00	ED
	2310-b	1 μa	3	110	25	25.00	ED
	2310-c	0.25 μa	3	1,800	250	25.00	ED
	2310-d	0.125 μa	3.5	10,000	1,000	25.00	ED
Pointer Galvanometer — Horizontal Scale (General-purpose galvanometer in its simplest form)	2320-b	4 μa	3	50	20	15.00**	ED
	2320-c	1 μa	3	950	250	15.00**	ED
	2320-d	0.5 μa	3	2,400	1,000	15.00**	ED
Portable Galvanometer—Horizontal Scale (Same as 2320, but for field use)	2322-b	4 μa	3	50	20	24.00**	ED
	2322-c	1 μa	3	950	250	24.00**	ED
	2322-d	0.5 μa	3	2,400	1,000	24.00**	ED
Pointer Galvanometer—Vertical Scale (Similar to 2320, but has vertical scale)	2330-b	4 μa	3	50	20	16.00**	ED
	2330-c	1 μa	3	950	250	16.00**	ED
	2330-d	0.5 μa	3	2,400	1,000	16.00**	ED
Ballistic Galvanometer (Specially designed for ballistic use)	2239-d	0.002 μq	26	10,000	2,000	35.00	ED
	2239-e	0.011 μq	24	230	60	35.00*	ED
	2285-d	0.0003 μq	27	40,000	700	115.00	ED
	2285-e	0.003 μq	25	500	12	115.00*	ED

* Price includes external resistor for critical damping.
** Less 10% for lots of 6 to 11; 20% for lots of 12 or more. A group of galvanometers subject to these discounts may include: 2320's only; 2322's only; 2320's and 2322's; or 2330's only.
*** Sensitivities are at least as high as stated; other characteristics within 20%. Microvolt sensitivities are for critica damping resistance in series. Coil resistances include suspensions.

2260
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2310
(about 1/1 actual size)

2320
(about 1/6 actual size)

2322
(about 1/6 actual size)

D-C MOVING MAGNET GALVANOMETER

Instrument	List Number	Sensitivity (Per mm at 1 meter)*	Period (Sec.)	Resistance of Fixed Coils (Ohms)	Price	Refer to Catalog
Coblentz Galvanometer (Primarily for use with thermopiles, in measuring minute quantities of radiant energy. More sensitive than moving-coil galvanometers. Has four fixed field coils which can be connected in three different electrical arrangements)	2270	Series 0.0002 μa 0.008 μv	8 (Approx.)	40	$500.00	ED
		Series-Parallel 0.0004 μa 0.004 μv	8 (Approx.)	10		
		Parallel 0.0008 μa 0.002 μv	8 (Approx.)	2.5		

* Sensitivity at least as high as stated; other characteristics within 20%. Voltage sensitivities are at galvanometer terminals, and will be proportionately reduced as total circuit resistance is increased. No damping resistance is stated as, practically, the damping is unaffected by changes in external circuit resistance.

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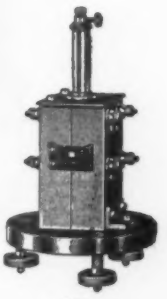

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A-C MOVING COIL GALVANOMETERS

Instrument	List Number	Sensitivity (Per mm at 1 meter or per scale Division)*	Period (Sec.)	Coil Resistance (Ohms)	Price	Refer to Catalog
High Sensitivity A-C Reflecting Galvanometer (For high sensitivity in 60-cycle bridge measurements)	2570	0.0035 μa	10	18	$350.00	ED
A-C Pointer Galvanometer (General-purpose a-c galvanometer in its simplest form)	2370-a	5 μa	2.6	20	60.00	ED
	2370-c	1 μa	2.6	250		
	2370-d	0.5 μa	2.6	1,000		

*Sensitivities at least as high as stated; other characteristics within 20%. Sensitivities stated assume that current in moving coil is in phase with current in field coil. Coil resistances include suspensions.

2570
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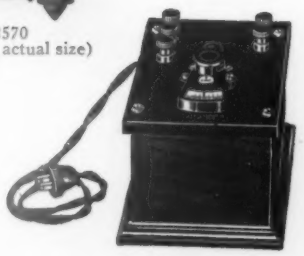

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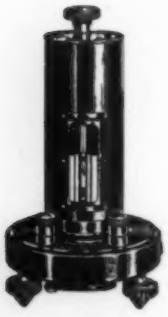

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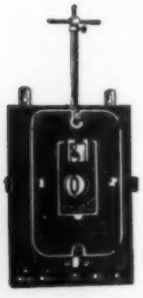

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A-C VIBRATION GALVANOMETERS

Instrument	List Number	Sensitivity (Per mm at 1 meter)*		Resonance Range, Per Cent		Resistance (Ohms)	Price	Refer to Catalog
		60 Cycles	3rd Harmonic	Current	Emf			
Vibration Galvanometer (For a-c measurements at commercial frequencies)	2350-a	0.025 μa 500.0 μv	111 μa	0.3	1.5	800	$150.00	ED
	2350-b	5.0 μa 2.0 μv	5,000 μv	0.3	0.7	0.25	150.00	ED
Vibration Galvanometer (Similar to 2350, but equipped with remote tuning device)	2351-a	0.025 μa 500.0 μv	111 μa	0.3	1.5	800	175.00	ED
	2351-b	5.0 μa 2.0 μv	5,000 μv	0.3	0.7	0.25	175.00	ED

* Sensitivities at least as high as stated; other characteristics within 20%.

ASTATIC DYNAMOMETERS

Instrument	List Number	Watt Sensitivity (microwatts)	Current Sensitivity (microamperes)*	Period (seconds)	Circuit	Total Resistance (ohms)	Total Inductance (millihenrys)	Continuous Current Rating (amperes)	Price	Refer to Catalog
High-Sensitivity Astatic Dynamometer (For dielectric-loss and other watt-dynamometer measurements)	2440	5	0.05	10	Moving Coils Fixed Coils	200 125	15 110	0.05 0.1	$275.00	ED
Astatic Dynamometer (For moderate sensitivity in educational and other laboratories)	2450	50	0.5	8	Moving Coils Fixed Coils	35 25	0.5 12	0.1 0.1	115.00	ED
Astatic Dynamometer with Enclosed Lamp and Scale (For many uses, including that of a null detector in measuring power factor of full-reel lengths of high-voltage cable)	2460	300	3	3.6	Moving Coils Fixed Coils	200 20	3.3 3.3	0.03 0.1	150.00	ED

* Sensitivities at least as high as stated; other characteristics within 20%. Sensitivities (per mm at 1 meter for 2440 and 2450; per mm division for 2460) are with fixed coil circuit separately excited and carrying full current. Watt sensitivity assumes sufficient external resistance for 110 volts, that is, total resistance 1,100 ohms.
On special order, we can furnish dynamometers built to specifications other than those above.

THE ELECTRO-CHEMOGRAPH

For Quantitative and Qualitative Analysis By Determination of Current/Potential Relations

Any investigator with a problem in chemical analysis may wish to look into the possibilities of the dropping mercury electrode method . . . which permits quantitative as well as qualitative measurements, and is applicable to organic as well as inorganic analyses.

As made available in the L&N Electro-Chemograph, the dropping mercury electrode method is both accurate and rapid. Already installed in many university and industrial research laboratories, this versatile equipment is proving its usefulness in an ever-growing number of applications.

An assembly of standard L&N units, the equipment is reliable and accurate. Outstanding advantages of the L&N equipment include:

1. The operator sees the current/potential curve being inked. 2. The wide chart is easy to read, accurate and permanent. 3. Darkrooms, developing processes and delicate galvanometer systems are eliminated. 4. Instruments are made up of standard L&N mechanisms, proved reliable throughout years of use in other applications. Details in Bulletin E-94(1).

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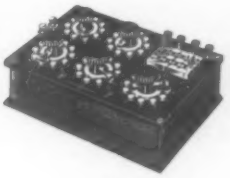

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4282
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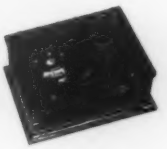

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A-C AND D-C BRIDGES

For general measurements of resistance and impedance, and for a number of specific quantities which can be measured in terms of resistance or impedance, we build a varied line of d-c and of a-c bridges. For many applications, you'll find a suitable, standard model . . . either among those here listed for research, teaching and testing; or among our industrial-type indicators, recorders and controllers. For unusual problems, we can supply either a modified standard bridge or, if necessary, build a special one. Whether you have in mind a general or specific use, we are prepared to provide the precision you desire in a well-made, reasonably-priced bridge which fits your need.

For specific work in laboratory, plant or field you will find a wide choice of models: for high or moderate precision; for table use or portable; for general use or specialized. In some, all components are self-contained. Others comprise simply the bridge-arm elements. Still others are separate slidewires and ratio boxes which can be combined with other units to form various bridge assemblies.

In the design of these instruments, convenience and speed of manipulation have been given full consideration. Dials, plugs, keys and switches are easy to handle. Engraving and calibrated scales are legible. Binding posts for external connections are readily accessible. And, in building up this diversified line, we have made a real effort to keep the cost of each model consistent with its value to the user.

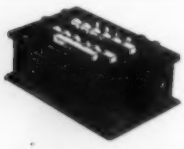
WHEATSTONE BRIDGES

Instrument	List Number	Ratio Arms	Rheostat	Limits of Error	Price	Refer to Catalog
Anthony-Pattern Wheatstone Bridge (Highly precise standard for checking instruments and for general laboratory use.)	4230	Double set of ratio resistors; two each of 1, 10, 100, 1000, 10,000Ω. Plug and block connectors.	Range 0 to 11,111Ω, adjustable in steps of 0.1Ω; five decades of ten resistors each, respectively, 0.1, 1, 10, 100, 1000Ω. Plug and block connectors.	In ratio resistors ±0.01%; of 0.1Ω rheostat resistors ±0.05%; of all others ±0.02%.	$650.00	E-53
Open-Dial-Switch Wheatstone Bridge (Conveniently, rapidly used bridge of high precision for general use.)	4725	Double set of ratio resistors; two each of 1, 10, 100, 1000, 10,000Ω. Plug and block connectors.	Range 0 to 10,000Ω, in steps of 0.1Ω; five decades 10 × 0.1 + 9 (1 + 10 + 100 + 1000)Ω. Open-dial switches.	In ratio resistors ±0.025%; in rheostat arm, resistance change from zero setting of dials equals ±(0.05% + 0.005Ω).	175.00	E-53
Enclosed-Switch Wheatstone Bridge (A compact, convenient bridge for moderate precision.)	4760	Seven multiplying values: 0.001, 0.01, 0.1, 1, 10, 100, 1000Ω. Enclosed-dial switch.	Range 0 to 9,999Ω, in steps of 1Ω; four decades 9 (1 + 10 + 100 + 1000) Ω. Enclosed-dial switch.	In ratio resistors ±0.05%; in rheostat arm, resistance change from zero setting of dials equals ±(0.1% + 0.01Ω).	55.00	E-53 EN-95
Post-Office Pattern Wheatstone Bridge (For student instruction.)	4250	Each has four resistors: 1, 10, 100, 1000Ω. Plug and block connectors.	Range 0 to 11,110Ω, in steps of 1Ω; 16 resistors, 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300, 400, 1000, 2000, 3000, 4000Ω. Plug and block connectors.	In ratio resistors ±0.05%; in rheostat arm, resistance change from zero setting of dials equals ±(0.1% + 0.01Ω).	60.00	E-53
Wheatstone Bridge Ohm-meter (A portable, slidewire-ratio bridge for rapid routine tests.)	4282	Slidewire approximately 12 inches, calibrated 0 to infinity.	Five standard resistors, respectively, 1, 10, 100, 1000, 10,000Ω. Plug and block connectors.	In standard resistors ±0.1%; in ratio values ±1% between 0.3 and 3; in resistance measurements ±1% between 0.3 and 30,000Ω.*	75.00	E-53
Per Cent Limit Bridge (For rapid inspection of resistors such as radio coils, magnetic windings, etc.)	4270	Range 0 to ±15%. Adjustable slidewires reading in % deviation from comparison standard for resistors of 1 to about 250,000Ω.	Uses standard comparison resistor.		50.00	E-53

* Stated limits of error assume that the built-in standard will be selected which keeps the reading as near as possible to the center of the scale.

KELVIN BRIDGES

Instrument	List Number	Ratio Arms	Comparison Standard	Range	Limits of Error	Price	Refer to Catalog
Precision Kelvin Bridge (For precise measurements of low resistance. Consists of two units: 4320 Ratio Box, and 4300 Adjustable Standard Low Resistance.)	4320 4300	Duplicate ratio arms, each including resistors of 100, 300, 400, 1000, 10,000Ω.	Nine fixed resistors each 0.001Ω and a 0.001Ω graduated bar having a scale of 110 divisions.	0.01 μΩ to 1Ω.	Of bridge ±0.04% down to 0.0001Ω; of ratio resistors ±0.015%; of fixed resistors ±0.04%; of graduated bar ±0.2 division.	$400.00	E-53



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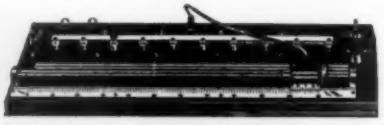

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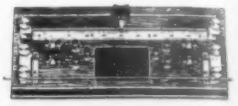

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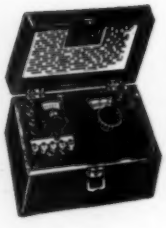

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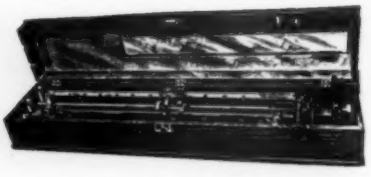

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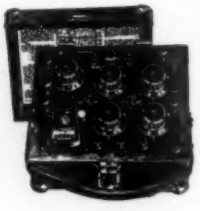

5430–A
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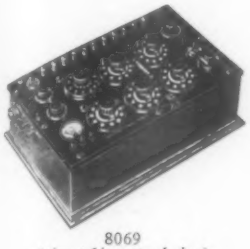
KELVIN BRIDGES (Cont'd.)

Instrument	List Number	Ratio Arms	Comparison Standard	Range	Limits of Error	Price	Refer to Catalog
General Purpose Kelvin Bridge (For moderate precision in low-resistance measurements.)	4306	Seven settings: 0.1, 0.2, 0.5, 1, 2, 5, 10.	Nine fixed sections and a divided bar section each of 0.01Ω; scale has 100 divisions.	0.00001Ω to 1Ω.	In ratio resistors ±0.05%; of standard ±0.05%; of scale ±0.2 division.	$200.00	E-53
Students' Kelvin Bridge (For teaching purposes.)	4340	Three settings: 0.1, 1, 10.	Bar, total resistance 0.01Ω; scale has 100 divisions.	0.00001Ω to 0.1Ω.	In ratio resistors ±0.2%; of standard ±0.5%; of scale ±0.5 division.	70.00	E-53 E-53(1)
Portable Kelvin Bridge (For low-resistance measurements of moderate precision in testing electrical materials.)	4285	Adjustable slidewires. Calibrated 1.5 to 2.66 and 1 to 1.6.	Dial switch. 0.0001, 0.0002, 0.0005, etc. up to 10Ω.	0.0001Ω to 26.6Ω.	±0.25% from 0.0005 to 26.6Ω; ±0.5% from 0.0001 to 0.0005Ω.	250.00	E-53
Kelvin Bridge Ohmmeter (A convenient portable bridge for low-resistance measurements in routine testing of windings, bars, rods, etc.)	4286	Adjustable slidewire. Calibrated 0.01 to 0.11.	Plug switch. 0.01, 0.1, 1, 10, 100.	0.0001 to 11Ω.	±2%.	120.00	E-53 EF22C
Hoopes Conductivity Bridge (For rapid routine comparison of wire and rod samples with standards of same material.)	4870	Adjustable to compensate for weight of sample. Calibrated ±15%.	4872 Copper Standard, calibrated according to International Annealed Copper Standard. Gauge Nos. 21, 18, 15, 12, 9, 6, 3 or 0, as specified, each for 3 consecutive gauge sizes.	0 to 115%.	±0.2%.	750.00	E-53

FAULT LOCATING BRIDGES

Instrument	List Number	Ratio Arms	Rheostat	Limits of Error	Price	Refer to Catalog
Type U Test Set (A portable Wheatstone bridge especially adapted for locating faults in communication circuits.)	5430-A	Multiplying values of 1/1000, 1/100, 1/10, 1/9, 1/4, 1/1, 10/1, 100/1 for resistance measurements and for Varley Loop tests; also settings of M1000, M100, M10 for ratios in Murray Loop tests. Enclosed-dial switch.	Four decades 10 (1+10+100) +9×1000Ω,+ infinity. Enclosed-dial switches.	In ratio resistors ±0.05%; in rheostat arm, resistance change from zero setting of dials equals dial readings ±(0.1%+0.01Ω).	$125.00	E-53 E-53-441(1)
Type S Test Set (A portable Wheatstone bridge for ordinary resistance testing and for locating faults in communication circuits.)	5300	Multiplying values of 0.001, 0.01, 0.1, 1, 10, 100, 1000 for resistance measurements and for Varley Loop tests; also settings of M1000, M100, M10 for ratios in Murray Loop tests. Enclosed-dial switch.	Four decades 9 (1+10+100+1000)Ω. Enclosed-dial switches.	In ratio resistors ±0.05%; in rheostat arm, resistance change from zero setting of dials equals dial readings ±(0.1%+0.01Ω).	90.00	E-53 E-53-400(1)
Power Cable Fault Bridge (For locating faults in power cables, at low voltages, by the Murray Loop method.)	5365	Adjustable slidewire.	None.	Will carry normal test-current of 5 amps. continuously; 8 amps. for a short time.	240.00	E-53 E-53-441(4)



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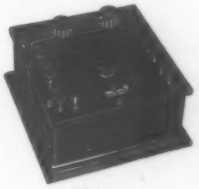

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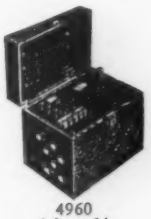

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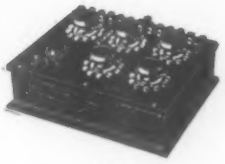

8067
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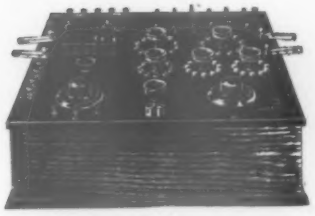

4666
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TEMPERATURE BRIDGES

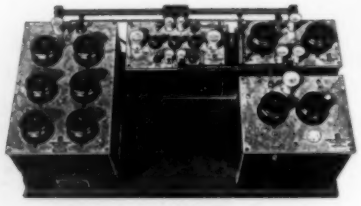
Instrument	List Number	Ratio Arms	Rheostat	Limits of Error	Price	Refer to Catalog
Type G-2 Mueller Bridge (For extremely high-precision temperature measurements by the electrical resistance-thermometer method.)	8069	Two ratio arms, 1000Ω each, adjustable to equality.	Range 0 to 111.111Ω in steps of 0.0001Ω. Three shunted decades giving steps of 0.0001, 0.001 and 0.01Ω; three decades of 0.1, 1 and 10Ω resistors. Principal shunted and decade resistors thermostatic to ±0.01 C near 35 C.	Resistance measurements within a few hundred thousandths of an Ω, or a few parts in a million, whichever is larger, provided a recently determined bridge calibration correction is applied.	$1050.00*	E-33C (1)
Type G-1 Mueller Bridge (For precision temperature measurements by the electrical resistance-thermometer method.)	8067	Ratio arms, 500Ω each, adjustable to equality.	Range 0 to 51.111Ω in steps of 0.0001Ω. Three shunted decades giving steps of 0.0001, 0.001, 0.01Ω; two decades at end of ratio arms of 0.1 and 1Ω resistors, and binding posts on end of rheostat for connection to 0, 10, 20, 25, 25.5, 30 or 40-Ω resistors.	±0.02% or ±0.0001Ω, whichever is greater.	340.00	E-33C (1)
Resistance-Thermometer Bridge (For moderate-precision temperature measurements by the electrical resistance-thermometer method.)	8063	Ratio arms, 130Ω nominal.	Range 0 to 200.1Ω. Two dial decades 9(1+10)Ω, and a 100-Ω resistor removable by short-circuiting link, plus adjustable slidewire of 1.1Ω.	±0.005Ω up to 10Ω ±0.05% above 10Ω.	135.00	E
Portable Temperature Bridge (Similar to 8063, but portable.)	8062	Ratio arms, 130Ω nominal.	Same as 8063.	Same as 8063.	200.00	E
Portable Temperature Indicator (Primarily for body-temperature measurements, with 8153 Resistance Thermometer.)	8016	Ratio 1 to 1.	Adjustable slidewire calibrated 90 to 110 F for 100Ω nickel thermometer.	Of indicator ±0.1 F.	130.00	E

* Calibration not included in list price. It is recommended that initial calibration be made by N.B.S. in accordance with their Schedule 114b...approximate cost, $60.00 plus shipping charges to and from Washington, D. C. Subsequent calibrations by the user, in accordance with directions supplied with instrument, require the use of an 8070 Calibrating Resistor...price $25.00.

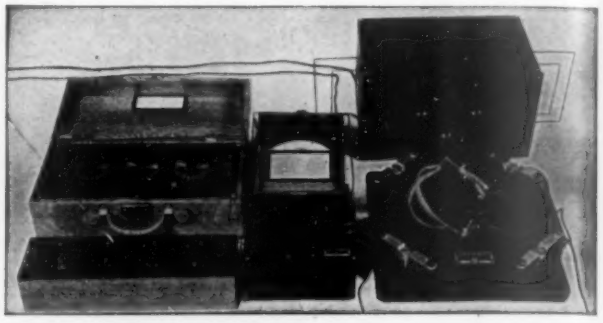
CONDUCTIVITY BRIDGES

Instruments	List Number	Ratio Arms	Rheostat	Range	Limits of Error	Price	Refer to Catalog
Jones Conductivity Bridge (A laboratory standard a-c bridge primarily for extremely precise measurements of electrolytic conductivity.)	4666	Two 1000Ω resistors adjusted to equality of d-c resistance within ±0.01%. Slidewire between ratio resistors adjusts ratio arms to equality within ±0.0002% and provides range of ratio from 0.999 to 1.001.	See range. Capacitors included to balance residual.	60,000Ω in steps of 0.1Ω.	At 20 to 30 C and at relative humidity not over 70%, ±0.02%, with calibration corrections on resistors, above 100Ω, ±0.005% or better obtainable.	$650.00*	EN-95 E
Portable Electrolytic Resistance Indicator (For general use in measuring the resistance of electrolytic solutions. Operates at 115 volts, 60 or 25 cycles.)	4960	Slidewire, direct reading in resistance.	Five standards: 1, 10, 100, 1000 and 10,000Ω.	0.3 to 30,000Ω.	±1% when built-in standards are selected to keep reading as near as possible to center of scale.	135.00	EN-95 E

9857
(about 1/16 actual size)



1554–A2
(about 1/30 actual size)



5337–A2; A1 is similar

CONDUCTIVITY BRIDGES (Cont'd.)

Instrument	List Number	Ratio Arms	Rheostat	Range	Limits of Error	Price	Refer to Catalog
Portable Conductivity Resistivity Indicator (For general use in measuring the specific conductance and specific resistance of electrolytic solutions. Operates at 115 volts, 60 cycles.)	4866	Slidewire, direct reading in conductivity and in resistivity.	Five standards: 38, 380, 3800, 38,000, 380,000Ω.	Specific conductance: 0.012 to 0.000,0001 mho per centimeter cube. Specific resistance: 80 to 10,000,000Ω per centimeter cube.	±0.3% of range.	$275.00	EN-95 E
Portable Sugar Ash Indicator (For determining the ash content of raw sugars from the conductance of sugar solutions. Operates at 115 volts, 60 or 25 cycles.)	4961	Slidewire, direct reading in conductivity.	Five standards: 2, 20, 200, 2000, 20,000Ω.	0.12 to 0.000,001 mho per centimeter cube. Corresponds to range 0.01 to more than 3% ash content of cane and beet sugar products.	±0.3% of range.	250.00	EN-95 E

* Adjustable capacitors, 50 to 1000 $\mu\mu f$ and 10 to 120 $\mu\mu f$ are supplied without calibration data. When specified, at time instrument is purchased, calibartion data suitable for measurements in terms of capacitance difference only will be supplied at an additional charge of $20.00.

FREQUENCY BRIDGES

Instrument	List Number	Ratio	Bridge Arms	Range	Limits of Error	Price	Refer to Catalog
Portable Frequency Indicators (Double-range impedance bridges.)	9857	Slidewire, direct reading in frequency.	Built-in mica capacitors and resistors.	58 to 62 and 24 to 26 cycles, for 115 volts.	±0.06 cycle at normal frequency; ±0.1 cycle at limits of range.	$250.00	E
	9858	Same as 9857.	Same as 9857.	58 to 62 and 48 to 52 cycles, for 115 volts.	Same as 9857.	250.00	E

IMPEDANCE BRIDGES

Instrument	List Number	Ratio Arms	Comparison Standard	Range	Limits of Error	Price	Refer to Catalog
Shielded Capacitance and Conductance Bridge Assembly (A high-precision bridge for determining power factor and related a-c characteristics of dielectrics up to 50 kilocycles.)	1554-A2	1553 Shielded Ratio Box.	4764 Six-Dial Shielded Resistance Box; 1187 Adjustable Air Capacitor.	Of capacitance, 0-1300 $\mu\mu f$; of conductance, 0-300 μmhos.	Of capacitance ±1 $\mu\mu f$; of conductance, depends on value.	$895.00	E
Shielded Capacitance and Conductance Bridge Assembly (Moderate precision.)	1554-A1	Same as 1554-A2.	4750 Six-Dial Shielded Resistance Box; 1187 Adjustable Air Capacitor.	Same as 1554-A2.	Same as 1554-A2.	695.00	E
60-Cycle Owen Bridge Assembly (For determining permeability and core loss of magnetic core materials at inductions of 10 and 1,000 gausses at 60 cycles.)*	5337-A1	1 fixed capacitor and 2 fixed resistors.	1070 Mica Capacitor. A 1 μf mica capacitor. 4745 Resistance Box.	Infinite.		755.00	E
1000-Cycle Owen Bridge Assembly (Similar to 5337-A1, but for tests at inductions of 10 gausses at 1000 cycles.)*	5337-A2	Same as 5337-A1.	Same as 5337-A1.	Same as 5337-A1.		765.00	E

* A. S. T. M. A-258-43T.

1202
(about ⅛ actual size)

1511–A1–A2
(about 1/10 actual size)

IMPEDANCE BRIDGES (Cont'd.)

Instrument	List Number	Ratio Arms	Comparison Standard	Range	Limits of Error	Price	Refer to Catalog
Schering Bridge Assembly (For measuring power factor and other dielectric characteristics of insulating materials. Maximum voltage 10 kv, 60 cycles.)	1511-A1	Fixed standard high-voltage air capacitor for one, and test specimen for other.	Adjustable air capacitor [range, 10 (0.1 + 0.01 + 0.001 + 0.0001 μf) + 110 μμf] for power factor readings, and adjustable decade resistors [range, 10(0.1 + 1 + 10 + 100 + 1000Ω) + 0.105Ω] for capacitance readings.	Capacitance: 40 μμf to 0.02 μf using 100 μμf standard, 10 kv air capacitor. Power Factor: 0.0001 to 0.70.	Capacitance: ±0.25% exclusive of the error of the high-voltage air capacitor. Power Factor: ±0.000,005 for power factor of 0.0001 when capacitance of specimen is at least 100 μμf and applied voltage not less than 3000 volts. ±0.005 for power factor of 0.5.	$2314.00	E-54 (Ω) E
Schering Bridge Assembly (Similar to 1511-A1, but maximum voltage 25 kv, 60 cycles.)	1511-A2	Same as 1511-A1.	Same as 1511-A1.	Same as 1511-A1.	Same as 1511-A1.	2514.00	E-54 (Ω) E
Fared Bridge (For comparing capacitances with self-contained standard capacitors.)	1202	Slidewire with 12-inch scale calibrated 0 to infinity.	Three standard mica capacitors, 0.001, 0.01 and 0.1 μf.	0.0003 to 1 μf.	Between 0.0003 and 0.003 μf, and between 0.3 and 1 μf, ±3%. Between 0.003 and 0.3 μf, ±1 to ±2%.	80.00	E
Capacitance Limit Bridge (For rapid inspection of capacitors. Operates on 115 volts, 60 cycles.)	1206	Adjustable top transformer reading in per cent deviation from comparison standard.	External comparison capacitor used, having capacity of 10 μf to 5 μμf. Not included in list price.	0 to ±30% of standard.		215.00	E

A-C AND D-C BRIDGE ACCESSORIES

D-C RATIO BOXES *

4392 **WENNER RATIO BOX.** For precise comparison of resistors of the same nominal value. Shows deviation from standard in parts per million. One ratio arm a fixed resistance of 100 ohms. Other arm adjustable between 99.445 and 100.555 ohms in steps of 0.001 ohm $215.00

4391 **L&N RATIO BOX.** For precise standardizing of resistors. Shows magnitude of unknown resistance in per cent of standard. Range 99.000 to 101.110 per cent in steps of 0.001 per cent. Compares resistors of same nominal value or in a ratio of 10:1 .....$195.00

A-C RATIO BOX *

1553 **CAMPBELL - SHACKELTON SHIELDED RATIO BOX.** For a variety of impedance bridges. Comprises a pair of accurately matched 1000-ohm resistors, a shielded transformer and auxiliary resistors and capacitors for adjusting initial balance $170.00

* Further information in Catalog E.

OSCILLATORS AND AMPLIFIERS *

9842 **VACUUM TUBE AUDIO FREQUENCY OSCILLATOR.** For 500, 1000 and 2000 cycles. Operates on 115 volts, 60 cycles $190.00

9847 **TUNED AUDIO FREQUENCY AMPLIFIER.** For 500, 1000 and 2000 cycles. Operates on 115 volts, 60 cycles $125.00

9846 **TUNED AUDIO FREQUENCY AMPLIFIER.** Same as 9847, but adapted for mounting on 19-inch telephone relay rack $135.00

9848 **COMMERCIAL FREQUENCY AMPLIFIER.** For amplification at 25 or 60 cycles $260.00

9850 **ELECTRONIC TYPE AUDIO FREQUENCY OSCILLATOR.** Delivers current of fair wave form at 1000 cycles. Operated by 115-volt motor. $150.00

9856 **MICROPHONE HUMMER.** Delivers current of fair wave form at 1000 cycles. Operates on 6 dry cells $34.00

TELEPHONE RECEIVERS *

9871 **TUNABLE TELEPHONE RECEIVER.** Total d-c resistance 120 ohms. Double receiver with headband $20.00

9872 **TELEPHONE RECEIVER.** Total d-c resistance 2000 ohms. Double receiver with headband..$5.50

9873 **TELEPHONE RECEIVER.** Total d-c resistance 130 ohms. Double receiver with headband..$12.00

9874 **TELEPHONE RECEIVER.** Impedance at 1000 cycles, 30,000 ohms. Double receiver with headband $20.00

POTENTIOMETERS

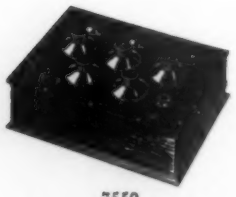
To determine emf as precisely as a given measurement demands, you can choose from a well-rounded line of L&N instruments, each of which applies the basically-sound potentiometer principle in a thoroughly reliable construction.* Designs, materials and workmanship are the results of years of extensive experience, during which we have had the close cooperation of leading scientists in developing potentiometers to meet the various needs of research, teaching and testing. Adjustments of slidewire uniformity, of resistor equality and of each potentiometer as a whole are made within conservatively safe limits. Each is a well-built, thoroughly-tested assembly on which the user can depend for full stability and reproducibility of measurements made within error limits which are definitely guaranteed. Each embodies accuracy, sensitivity and readability in such proportion that the precision guaranteed is readily attainable.

From the simplest model to the most precise, each L&N potentiometer is, in its intended service, a strikingly convenient instrument to use. Well-placed, easy-to-grip controls enable the operator, while balancing the potentiometer, to keep an uninterrupted eye on his galvanometer reading device. Auxiliary keys, switches and knobs are simplified, handy. Standard cell can be applied quickly and easily. Binding posts are readily accessible, but so located that, while the instrument is in use, external connections are out of the operator's way.

The earned reputation which attaches to every L&N potentiometer arises out of the fact that each, in its field, is built to give the required precision, with maximum convenience and speed of manipulation, at a cost in keeping with its value to the user.

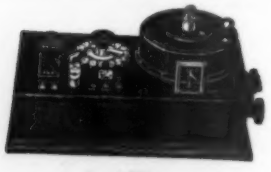
* "Design of Potentiometers," I. M. Stein, A.I.E.E. Transactions, Vol. 50, No. 4, 1931.

D-C NULL POTENTIOMETERS



7559
(about 1/20 actual size)

7620
(about 1/12 actual size)



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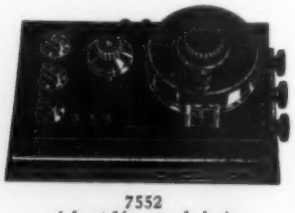
(about 1/12 actual size)



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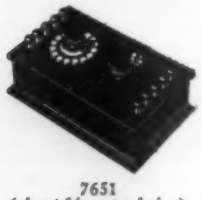

7651
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Instrument	List Number	Range	Limits of Error	Price	Refer to Catalog
Wenner Thermocouple Potentiometer (For highly precise measurements of low voltages; primarily for thermocouple work.)	7559	High: 0 to 0.11111 volt in steps of 1 μv. Low: 0 to 0.011111 volt in steps of 0.1 μv.	High range: ±(0.01%+0.5 μv). Low range: ±(0.01%+0.1 μv).	$1245.00*	E-33A(1) E
Wenner Standardizing Potentiometer (Similar to 7559, but for higher voltages.)	7558	High: 0 to 1.9111 volts in steps of 10 μv. Low: 0 to 0.19111 volt in steps of 1 μv.	High range: ±(0.01%+5 μv). Low range: ±(0.01%+1 μv).	1070.00*	E
White Single Potentiometer (For precision temperature measurements in calorimetry and other low-voltage applications.)	7620	0 to 0.01 volt in steps of 1 μv.	±(0.02%+0.5μv).	500.00	E-33A(2) E
White Single Potentiometer (Same as 7620, except for greater range.)	7621	0 to 0.1 volt in steps of 10 μv.	±(0.02%+1 μv).	500.00	E-33A(2) E
White Double Potentiometer (Has two sets of measuring dials, controlled by a master switch, so that two widely different temperatures may be m asured without resetting dials.)	7622	0 to 0.01 volt in steps of 1 μv.	±(0.02%+0.5 μv).	800.00	E-33A(2) E
White Double Potentiometer (Has two sets of measuring dials, controlled by a master switch, so that two widely different temperatures may be measured without resetting dials.)	7623	0 to 0.1 volt in steps of 10 μv.	±(0.02%+1 μv).	800.00	E-33A(2) E
Type K-1 Potentiometer (A double-range precision potentiometer for general laboratory use.)	7551	High: 0 to 1.61 volts; Low: 0 to 0.161 volt.	When using 3 or more switch studs: low range 0.02%, high range 0.01%.	250.00	E-50B(3) E EN-96
Type K-2 Potentiometer (A triple-range precision potentiometer for general laboratory use. Additional low range especially useful for thermocouple work, and for checking industrial potentiometer pyrometers. Special terminals provide fixed potentials for checking lab-standard wattmeters. Improved controls make operation easier.)	7552	High: 0 to 1.61 volts; Medium: 0 to 0.161 volt; Low: 0 to 0.0161 volt.	When using 3 or more switch studs: high range 0.01%, medium and low ranges 0.015%.	300.00	E-50B(3) E EN-96
Students' Potentiometer (A simplified, moderate-precision potentiometer for educational and general laboratory use.)**	7651	High: 0 to 1.6 volts. Low: 0 to 0.016 volt.	Dial resistors and total slidewire resistance alike within ±0.04%; slidewire uniform within ±0.5 division.	70.00	E-50B(1) EN-96 E

* Price includes N.B.S. Certification.
** Separate connections to slidewire and end coils provided, so that slidewire of 7651 can be used in an a-c bridge.

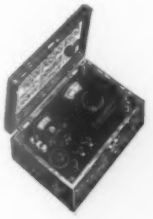
NULL POTENTIOMETERS (Cont'd.)

Instrument	List Number	Range	Limits of Error	Price	Refer to Catalog
Portable Millivolt and Temperature Indicator (For precise checking of thermocouple pyrometers in laboratory and plant, and for general temperature measurements. Used with noble-metal and base-metal couples. Range calibrated on dial switch and slidewire.)	8662	High: 0 to 80.5 mv. Low: 0 to 16.1 mv. Reference-junction compensators: 0 to 1 mv, adjustable to 0.002 mv; 0 to 5 mv, adjustable to 0.01 mv. Either compensator may be used with either main range.	Low main range and low-range compensator, ±0.01 mv. Low main range and high-range compensator ±0.02 mv. High main range and either compensator, ±0.05 mv.	$225.00	E-33A-503 E
Portable Millivolt Indicator (Convenient for pH and other emf measurements. Range calibrated on dial switch and slidewire.)	7655	0 to 1.110 volts. Double and triple range instruments supplied on special order.	±0.001 volt.	140.00	EN-96 E
Portable Millivolt and Temperature Indicator (For checking thermocouple pyrometers in the laboratory, and for general temperature measurements. Range calibrated on dial switch and slidewire. Used primarily with base-metal couples.)†	8667	0 to 111 mv.	±0.1 mv.	140.00	E-33A-503 E
Portable Millivolt and Temperature Indicator (For checking thermocouple pyrometers in the plant, and for general temperature measurements. Used with noble-metal and base-metal couples. Range calibrated on slidewire only.)	8657-C	Low: 0 to 16 mv. High: 16 to 64 mv. Reference-junction compensators: hand operated, 0 to 1 mv; 0 to 5 mv. Either compensator may be used with either main range.	Low main range with either compensator, ±0.05 mv. High main range with either compensator, ±0.15 mv.	145.00	E-33A-503 E
Portable Millivolt and Temperature Indicator (Same as 8657-C, except main ranges and compensator ranges in millivolts or temperature, as specified.)	8657-X	As specified.	Same as 8657-C.	155.00	E-33A-503 E
Portable Millivolt and Temperature Indicator (For checking thermocouple pyrometers in the plant, and for general temperature measurements. Used principally with noble-metal couples. Range calibrated on slidewire only.)	8656-B	0 to 16 mv. Reference-junction compensator: hand operated, 0 to 1 mv.	±0.05 mv.	120.00	E-33A-503 E
Portable Millivolt and Temperature Indicator (For checking thermocouple pyrometers in the plant, and for general temperature measurements. Used principally with base-metal couples. Range calibrated on slidewire only.)	8656-D	0 to 70 mv. Reference-junction compensator: hand operated, 0 to 5 mv.	±0.23 mv.	120.00	E-33A-503 E
Portable Millivolt and Temperature Indicator (Same as 8656-B, except main range and compensator range in millivolts or temperature, as specified.)	8656-X	As specified.	Same as 8656-B.	125.00	E-33A-503 E
Portable Millivolt and Temperature Indicator (For body-temperature measurements with hypodermic and skin-surface thermocouples.)	8663-CD	25 to 125 F, and −3.9 to +51.7 C for iron and constantan thermocouples. Reference-junction compensator automatic.	Of indicator only: ±0.5 F.	155.00	E-33-423 E
Universal pH Indicator (A compact, portable instrument which combines laboratory accuracy and sensitivity with speed and convenience. Direct-reading with its own self-contained glass electrode or with quinhydrone, hydrogen gas or any other electrode following the Nernst equation.)	7663-A1	0 to 13 pH in 0.1 pH divisions. 0 to ±1.100 volts in 0.01 volt divisions. Temperature compensator range 0 to 50 C in 1 degree divisions.	pH scale, ±0.05 pH (exclusive of any error in stated pH of buffer solution). Voltage scale, ±0.0037 volt. Error due to control current, less than 0.002 volt per 1000 megohms in measured circuit. Reproducibility, 0.02 pH.	240.00	E-96(3) E

† Does not have reference-junction compensator. Use of ice bath is recommended for reference junction.

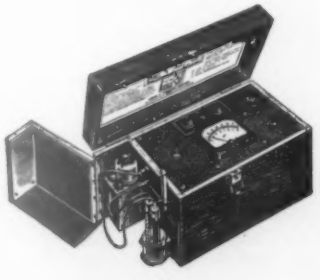
8662
(about 1/24 actual size)

7655
(about 1/20 actual size)



8657–C
(about 1/12 actual size)

7663
(about 1/12 actual size)



7662
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7630
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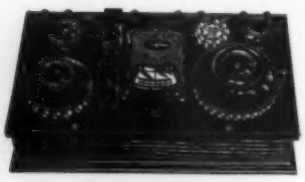

7640
(about 1/12 actual size)

DEFLECTION POTENTIOMETERS

Instrument	List Number	Range	Limits of Error	Price	Refer to Catalog
Glass-Electrode pH Indicator (Potentiometer of variable current type in which the meter deflection is a complete indication of the measured quantity.)	7662-A1	0 to 8 pH and 6 to 14 pH.	±0.1 pH, exclusive of any error in pH of standardizing buffer solution.	$160.00	E-96(2)
Brooks Model 7 Deflection potentiometer (For rapid testing of ammeters, voltmeters and wattmeters.) Uses partial deflection method, the greater part of the measured emf being balanced against the standard emf and the remainder measured on a calibrated galvanometer.	7630	0 to 150 mv.	For combined null and deflection readings, ±(0.02% + 0.03 mv).	425.00	E-50B(2) E
Brooks Model 8 Deflection Potentiometer, similar to 7630. (For measuring voltage and current in lamp-efficiency testing.)	7640	0 to 1.5 volts.	For combined null and deflection readings, ±(0.02% + 0.3 mv).	575.00	E-50B(2) E

PRIMARY ELEMENTS, ACCESSORIES, SUPPLIES

We are prepared to supply complete laboratory measuring equipments. In addition to the Standards, Galvanometers, Bridges and Potentiometers listed in this advertisement, the L&N line includes the various additional units and accessories often needed.

For certain applications there is a wide choice of primary elements: for temperature—thermocouples, Rayotubes, resistance thermometers; for pH—glass, calomel, hydrogen, etc. electrodes; for electrolytic conductivity—laboratory and industrial conductivity cells.

Accessories are supplied for use specifically with galvanometers and dynamometers. Devices are available for mounting a galvanometer on a tripod, on a table, or on a wall. There is a choice of devices for reading galvanometer deflections with a plane mirror and a convex lens or with a concave mirror; also scales with lamps and telescopes—including a lecture room lamp and scale for demonstrating galvanometer deflections to a large assembly. As voltage source for illumination, an a-c transformer or a d-c resistance unit is used. For use as current dividers, Ayrton shunts in a choice of total resistances are available. For damping a galvanometer or for protecting a galvanometer, standard cell or other instrument against excessive current, a choice of mounted resistors is supplied.

If the user prefers to assemble a bridge from separate units, the 4261 Circular Slidewire or the 4258 Kohlrausch Slidewire is available and the 7651 Students' Potentiometer is equipped with binding posts by means of which its slidewire can be used in a conductivity bridge assembly.

For making up a variety of a-c bridge assemblies, the Campbell-Shackelton A-C Ratio Box is available; for d-c bridge assemblies, an L&N Ratio Box or a Wenner Ratio Box is supplied.

Accessories for impedance measurements at power or audio frequencies include amplifiers; oscillators; phones or galvanometers for use as balance-point detector.

Where potentiometers are used, we supply a complete line of volt boxes and shunts. With either a null or deflection potentiometer when voltage above the nominal range of the instrument is measured, a suitable volt box may be used.

Specific literature describing primary elements, accessories and supplies not listed here is available on request.

MISCELLANEOUS LABORATORY APPARATUS

TRANSFORMER TESTING APPARATUS *

7190-A POTENTIAL TRANSFORMER TEST APPARATUS. Primary apparatus for laboratory tests. Range 0 to 15 000 volts. Galvanometer not included in price $2500.00

7160 POTENTIAL TRANSFORMER TEST SET. For testing potential transformers in service or in the laboratory. Ratio range 95 to 105%. Limit of error ± 0.1% ratio. Phase-angle range, 2 degrees lagging to 2 degrees leading; limit of error ± 5 minutes. Operates on 115 volts, 60 or 25 cycles. Includes galvanometer $250.00

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7181-A CURRENT TRANSFORMER TEST APPARATUS. Similar to 7180 A, but range 0 to 2500 amperes $3480.00

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6700-A1 KNORR-ALBERS MICROPHOTOMETER. For spectrographic analysis. Automatically scans spectrographic plates or films and draws line-density records on wide strip-chart $3750.00

* Further information in Catalog E.

Weston Electrical Instrument Corporation

601 FRELINGHUYSEN AVENUE, NEWARK, N. J.

—WESTON INSTRUMENTS—

The Standard for

INSTRUCTION · RESEARCH · INDUSTRY

Weston Instruments are the accepted standard of dependable measurement in educational institutions, scientific laboratories and throughout Industry. Educators know that the student years are the impressionable years. Exacting standards learned then will ultimately bear fruit in electrical progress during graduates' engineering careers and add to the prestige of the schools. The models listed and described are extensively used in schools and can be furnished in all practical ranges. Information on the complete Weston line sent promptly on request.

PORTABLE AND PANEL INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

INSTRUMENT TRANSFORMERS
Potential and Current

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ELECTRIC TACHOMETERS
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LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
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*Photronic — A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.

ELECTRICAL WESTON INSTRUMENTS

Instruments for Every Classroom

Model 430

Portable A C and D C

Voltmeters • Ammeters • Single Phase Wattmeters

Extensively used in technical schools and throughout industry for general test work, because they are extremely compact, and combine unusual ruggedness with dependable accuracy. The unusually large scale opening permits good visibility of the long hand calibrated mirror scales with knife edge pointers. Contained in molded Bakelite cases provided with leather carrying strap. Size approximately 5-1/16″ x 6-1/32″ x 3-1/2″. Weight approximately 3-1/2 lbs.

Model 622

AC and DC Ultra-Sensitive Instruments

A group of high-sensitivity instruments requiring no leveling. Ideal for precision measurement of potentials and minute currents involving electronics, thermo-couples or laboratory research. Available as DC Voltmeters, Millivoltmeters, Milliammeters, Microammeters. Also AC Thermo Ammeters, Thermo Milliammeters, Thermo Voltmeters.

Model 280

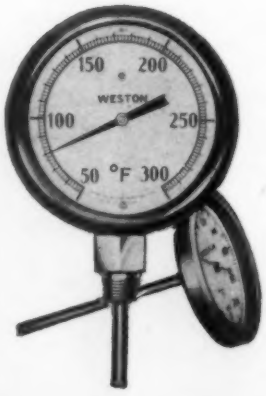
Miniature DC Instruments

Available in single and multi-range, portable models which are most convenient for student use on a variety of testing. Features are: 1% accuracy, ruggedness, hand calibrated mirror scales, knife edge pointers and magnetic shielding. Size 4-2/5″ x 4-3/5″ x 1-1/2″.

Model 375

Student Galvonometer

Made in two models, with or without mounting base. Widely used in school laboratories where dependability and low cost are first considerations. Sensitivity is 22 microamperes. Resistance 23 ohms. Models also available where medium or extreme sensitivity is required.



TEMPERATURE GAUGES

Laboratory and Industrial Types

Weston all-metal temperature gauges have large gauge-type scales which provide extreme readability, even at a distance. The laboratory model is guaranteed accurate within ½ of 1% over full scale and the industrial types within 1% of full scale. As there are no fragile parts, accuracy is maintained over far longer periods and they withstand vibration and accidental breakage.

and Laboratory Requirement

WESTON ELECTRICAL INSTRUMENTS

Model 785

DC-AC Industrial Circuit Tester

Ultra-Sensitive • 27 Ranges

A low current-drain instrument for school laboratories and general industry. Designed to perform a wide range of electrical measurements of currents, voltages and resistances. It has a sensitivity of 20,000 ohms per volt for DC and 1000 ohms per volt for AC. Especially useful for checking and trouble-shooting on electronic devices, sensitive relays, oscilloscopes and other apparatus with critical electrical settings. Comes equipped with test leads; also self-contained battery to provide potentials for resistance readings. Furnished in a sturdy, portable case with test lead compartment and removable cover.

Model 697

Volt • Ohm Milliammeter AC • DC

Provides a carefully selected group of ranges for most requirements for measuring AC and DC voltages, direct current and resistance values. Sensitivity 1000 ohms per volt. Self-contained battery provides potentials for resistance measurements. Comes equipped with test leads for insertion in pin jacks on panel. Size 5-9/16" x 3-3/4" x 3-9/16". Approx. weight 1-3/4 lbs.

Model 564

DC Volt-Ohmmeter

Model 564 is somewhat similar in appearance to Model 697 and will appeal to school heads where testing and experimentation require only DC voltage or resistance measurements. The ranges have been carefully planned to provide the electrical measurements frequently needed for student instruction. Size approximately 4-1/2" x 3-5/8" x 3-9/16". Approximate weight 1-3/4 lbs.

Model 594—Type 3

Photronic Cell

Weston Photronic cells are of the barrier-layer, self-generating type. They combine stability with high sensitivity, and freedom from fatigue. Can be safely operated up to temperatures of 140° F. Bakelite case and threaded terminals are standard equipment; can also be supplied with weather-proof housing and prongs for UX socket.

Model 633

AC Clamp Ammeter

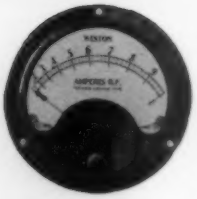
Readings are speedily taken with this compact circuit checker simply by closing the rubber-covered jaws around the conductor or switch blade. No hook-ups necessary, no interruption of circuit. Six ranges available through convenient thumb switch Simple and safe for student use. No shorting of adjacent conductors.

WESTON PANEL INSTRUMENTS

Design instructors will appreciate the wide selection of Weston panel instrument models. They will fill every requirement for attractive appearance, utility and dependable measurement.

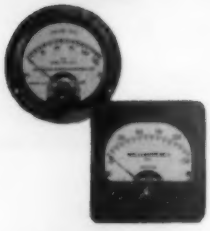
Model 801 Group — Rectangular

Exceptional scale length, readability, and ease of mounting are the features of this general purpose group. Made in all types and ranges for practical AC and DC use. Cases are black, semi-flush Bakelite 4-1/4" x 3-15/16". Scale length 3.17".



Model 640 Group — Round

A line of AC and DC instruments available in all practical ranges. Standard case is 4-3/8" dia., flush Bakelite. Surface Bakelite and flush or surface metal cases are optional. Scale length 3.34".



Model 301 Group Round or Rectangular

A group of compact AC and DC panel instruments, measuring approximately 3-3/8" dia., available in all required types and ranges. Round shapes furnished with flush Bakelite cases. Rectangulars, flush or surface in either Bakelite or metal.

Model 269 Group — Fan Shape

A very attractive group of wide range DC instruments with the longest scales ever attained for comparable sizes. Accuracy 1%. Available in four scale lengths 2.6"—4"—5.8"—7.32"; and supplied in surface types, black finished steel cases.

WESTON ILLUMINATION METERS

Weston Illumination Meters

Model 703, pocket size and entirely self-contained. Measures directly in foot-candles, range 0-75 fc. Available with Viscor filter for measuring all types of lighting direct, regardless of color characteristics.

Model 614, has three ranges, available through range changing switch . . . 0-60/0—120/—0-600/foot candles. Also available with the Viscor filter as described above.

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601 FRELINGHUYSEN AVENUE, NEWARK, N. J.

GENERAL ELECTRIC COMPANY

General Office, 1 River Road, Schenectady 5, N. Y.

Plan Your Postwar School Laboratory and Shop NOW

FEDERAL, State, and local governments are laying plans to give adequate technical training to the returned soldiers, sailors, and marines who desire it.

After the war—as during the war—highly trained technical workers will be much in demand. Classes in laboratory and shop will increase in size and in numbers. New and enlarged accommodations will be required.

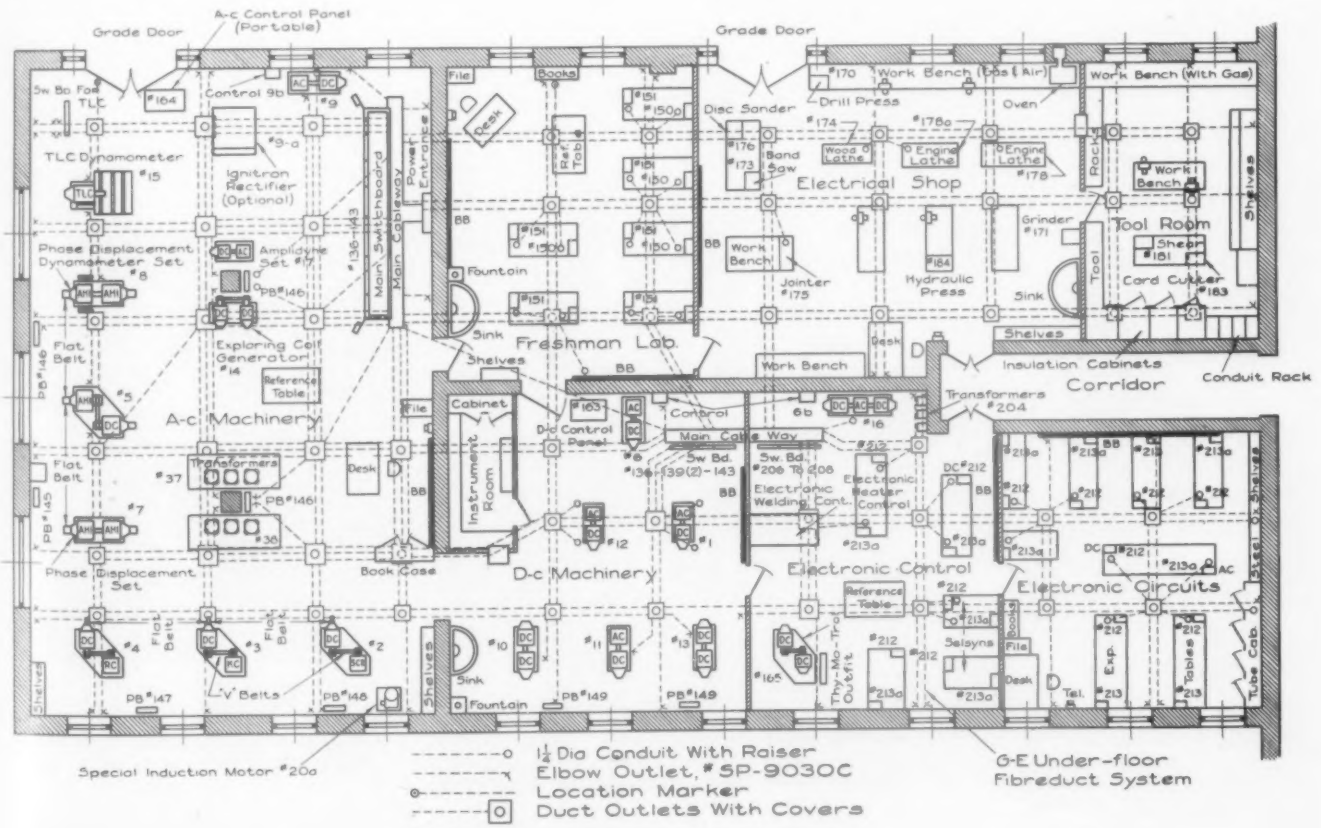
Competent G-E engineers stand ready to recommend laboratory equipment for the various types of courses required, and to help also in the preparation of shop and laboratory layouts, as illustrated by Fig. 1.

Various General Electric Company services include:

Advisory service to educators
Technical and descriptive publications
Special educational aids—such as motion pictures and illustrated lectures
Proper laboratory equipment.

To assist our engineers, we have retained the services of experienced educators. Hence, G-E recommendations can be relied upon to conform to the best educational and industrial practice. There is no charge for this advisory service.

It is not too early **now** to ask for the services of G-E engineers to assist you in making initial plans for the postwar period.


Grade Door
A-c Control Panel (Portable)
Grade Door
Electrical Shop
Freshman Lab.
A-c Machinery
D-c Machinery
Electronic Control
Electronic Circuits
Corridor
Tool Room
Work Bench (Gas)
Work Bench (Air)
Drill Press
Oven
Disc Sander
Band Saw
Engine Lathe
Hydraulic Press
Grinder
Jointer
Sink
Fountain
Shelves
Work Bench
Desk
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Insulation Cabinets
Conduit Rack
Main Switchboard
Power Entrance
Main Cable Way
Sw. Bd. #206 To 208
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Flat Belt
Phase Displacement Set
Phase Displacement Dynamometer Set #8
TLC Dynamometer #15
Ignitron Rectifier (Optional)
Amplidyne Set #17
Exploring Coil Generator #14
Control 9b
Sw Bd For TLC #164
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Books
File
Rack
Shelves
Tool
Card Cutter #163
Sheer #151
Work Bench
Lathe
Engine Lathe #178
Wood Lathe
Grinder #171
Hydraulic Press #184
Jointer #175
Band Saw #173
Disc Sander #176
Drill Press #174
Work Bench #170
Oven
Work Bench (Gas)
Work Bench (Air)
Desk
Fountain
Sink
Shelves
Work Bench
Insulation Cabinets
Corridor
Conduit Rack
Transformers #204
Control
Main Cable Way
Sw. Bd. #206 To 208
Electronic Welding Cont.
Electronic Heater Control
Reference Table
Selsyns
Thy-Mo-Trol Outfit
Tube Cab. Of Steel Or Shelves
Tables
Exp.
Tel.
Special Induction Motor #20a
V Belts
Flat Belt
Phase Displacement Set
Book Case
Instrument Room
Cabinet
Desk
Shelves
Sink
Fountain
Transformers
Exploring Coil Generator #14
Reference Table
Amplidyne Set #17
Ignitron Rectifier (Optional)
TLC Dynamometer #15
Phase Displacement Dynamometer Set #8

LABORATORY AND SHOP EQUIPMENT SPECIFICATIONS—BULLETIN GED-1093

THIS publication will aid in your selection of equipment for the electrical shop or laboratory. It is an enlarged revision of GEB-62 which has been used extensively for years as a guide by electrical teachers throughout the country.

The bulletin reflects present-day trends in technical education. In particular, the Electronics Laboratory section has been completely revised and expanded to list apparatus which should be adequate to provide apparatus for a well-balanced course in Electronics Control. The selection of a dead-front switchboard for the laboratory was the result of a marked trend in industrial practice to that type of board.

As described later, three price groups, "A," "B," and "C," have been retained in the revised bulletin. It is recognized that schools differ in the scope of the training offered and in the money available for laboratory expenditure. Apparatus in the lower-priced groups forms part of the complete equipment, so that a school which wishes to expand its laboratory will find that none of the apparatus originally purchased need be discarded. The lists are merely suggestive, as they will not fit all types of courses. Recommendations covering special courses will be prepared and laboratory layouts made on request. There is no charge for this service.

General Suggestions

The apparatus lists are based on a class of from 18 to 25 students. This is about the maximum which an instructor can handle efficiently at one time. However, with the larger equipment groups, there should be sufficient apparatus to permit several classes to operate at one time if the classes are of different grades so that experiments can be diversified.

In general, the apparatus selected is of standard commercial design. In some instances, special terminal boards have been provided or extra leads brought out in order to facilitate the work in the laboratory. In a few cases where standard apparatus is too large for efficient laboratory operation, special laboratory models have been designed. These special machines embody all of the basic principles of the commercial types, but are reduced in size so that they will operate satisfactorily with other laboratory apparatus.

Although some direct-connected motor-generator sets are listed, the V-belt drive has proved to be one of the most satisfactory types for certain laboratory motor-generator sets. It is convenient, positive, and quiet, and its added flexibility is an advantage in the laboratory. One of the main advantages is that belts can easily be removed, thereby allowing the machines of the set to be operated individually.

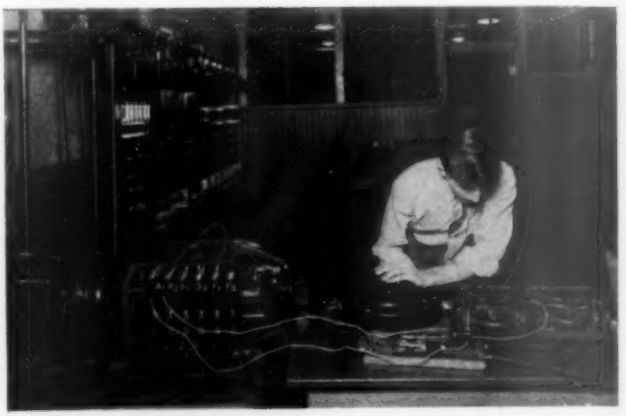


Fig. 2.
The new G-E *Terminal Board No. 4* (listed in Bulletin GED-1093) connected for testing the d-c unit of a motor-generator set. In this case, the student must make all connections, test them for polarity, etc.

Fig. 3.
This shows the motor-generator set illustrated in Fig. 2, but here connections are made for utilizing the set as a source of laboratory supply. The design of the terminal board aids materially in increasing the flexibility of motor-generator sets for laboratory work. Connections can be changed very quickly—which is especially desirable when there are only a few minutes between classes.

Cement mounting blocks 22 inches high are recommended. The blocks should not be fastened to the floor, and it is well to use two or three layers of corrugated pressboard or ½ inch of Celotex between the blocks and the floor. This arrangement decreases the noise and facilitates later rearrangement of the equipment, if necessary.

In preparing the lists, General Electric has kept a fairly definite proportion between the amounts to be spent for the various groups of equipment, such as machines, loading devices, control equipment, instruments, etc. A safe plan is to allow something under 25 per cent of the total sum available for instruments, something under 33⅓ per cent for motors and generators, and the remainder for the rest of the equipment.

Another rule, in planning a new building for technical courses in mechanical and electrical work, is to allow twice as much floor space for the electrical laboratory as for the machine shop, but about twice as much money for the machine shop as for the electric equipment. This is assuming that the same number of students is to be instructed in each course.

Laboratory Power Supply and Switchboard

An adequate power supply with good voltage regulation is essential for accurate laboratory work. The dead-front switchboard now recommended and standardized for laboratory use provides for a 3-phase, 220-volt, 200-ampere main power supply, and a single-phase 110/220-volt, 75-ampere, 3-wire supply. The main d-c feeder panel is also designed to handle 200 amperes, d-c, at 125 volts.

General Electric has given special attention to the design of this laboratory switchboard. It is made up of standard equipment and is exceptionally well adapted for both a-c and d-c machine operation and general laboratory distribution. Panels can be operated as units or as part of the entire board. Schools can, therefore, build up the complete board as enrollment grows and money becomes available.

This redesigned laboratory switchboard, now built in the dead-front type, familiarizes the student with modern practice. However, that it is still an educational board has been kept in mind, and its educational features have been retained.

In the layout of the laboratory, adequate distribution facilities from the switchboard to the laboratory stations should be given careful study. For this purpose, G-E plug-switch panels can be placed at advantageous points in the laboratory to facilitate the interconnection of various machines through the main switchboard. They are a vital part of the distribution system.

Smaller test-table outlet boxes have also been designed for use with lighter apparatus, such as is found in the electronics and physics laboratories.

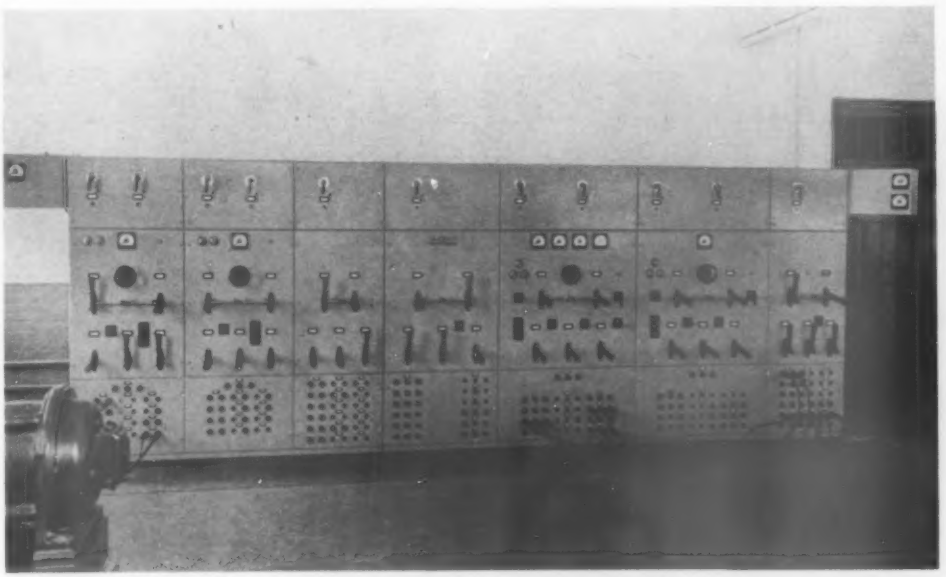


Fig. 4.
New dead-front-type main laboratory switchboard

LAYOUTS

In many schools, the economical use of floor space necessitates great care in selecting the location of the switchboard, the proper placing of floor ducts, and the exact setting of the apparatus. General Electric engineers will assist schools in deciding these important questions. Typical layouts showing suitable arrangements of the "A" and "C" groups of equipment are shown in Bulletin GED-1093. However, the Company will be glad to prepare special recommendations and make layouts where the standard lists are not suitable.

Those desiring to take advantage of this service should give the following information, so that recommendations will adequately meet all requirements:

1. Is the school to offer technical, vocational, or industrial-arts courses?
2. Is it a day or evening school?
3. What is the length of the course in years, days per week, and hours per day?
4. What is the average number of students who will be using the laboratory at one time?
5. Will the school be held in a new or old building?
6. What type of floors will be used, and will the laboratory be on the ground floor or above?
7. Include a simple floor plan of the rooms available, and indicate the scale, the size and location of windows, doors, partitions, sinks, columns, etc.
8. What power supply is available, and where is it located with reference to each room?

Fig. 5.
The new G-E educational *Terminal Board No. 3* (listed in Bulletin GED-1093) used on a d-c generator. The connections shown are for a standard load-voltage-characteristic test.

GROUP "A" EQUIPMENT

A careful study of the bulletin will show that **Group A** provides sufficient equipment for a first-class technical high school, technical institute, or as a basic list for an engineering college. In a technical high school, it will be sufficient for a high-grade four-year electrical course for the instruction of some 250 students per day, allowing a 2-period session for each class. Careful scheduling and diversification of experiments should make it possible to care for four, or possibly five, classes of 25 students each at one time.

This equipment is especially well adapted for the trade-extension or co-operative apprentice training classes that are springing up rapidly as a result of State and Federal aid.

GROUP "B" EQUIPMENT

This intermediate group will provide minimum equipment for a technical institute, and is sufficient for a high-grade technical high school. The additional items beyond those of **Group C** will materially broaden the scope of the work. Not only are more advanced experiments possible, but if sufficient room is available and the work is diversified, it should also be possible to handle three classes in the laboratory at one time. This group also includes sufficient electronics equipment for a very thorough course in industrial electronics.

Fig. 6.
In this illustration, the d-c unit shown in Fig. 5 is used to provide load for an a-c motor. The required change in connections is made quickly by means of the spring terminals on the terminal board.

Fig. 7.

A portable three-phase saturable-core reactor designed for use as a low-power-factor loading device in electrical laboratories. The full-wave thyratron rectifier at the rear supplies direct current for saturating the reactor core. The lead coiled above it can be readily plugged into the nearest 110-volt a-c outlet.

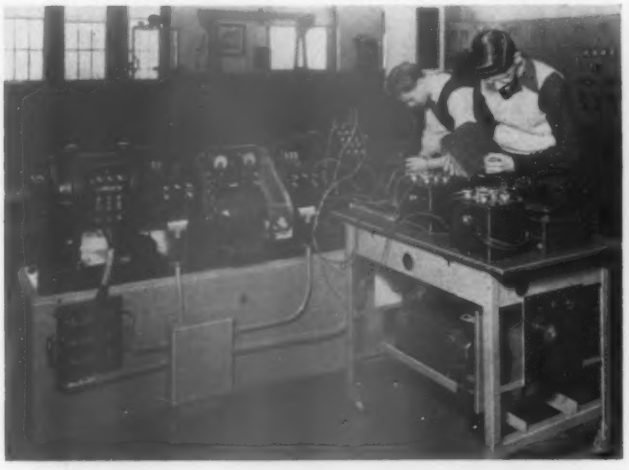


Fig. 8.

This shows the reactor illustrated in Fig. 7 in use with *Motor-generator Set No. 7* (listed in Bulletin GED-1093). The instrument on the control panel shows the d-c or saturation current, and the small rheostat button at the right provides an easy means of controlling the load on the alternator. The students are checking the speed of the set and the connections.

GROUP "C" EQUIPMENT

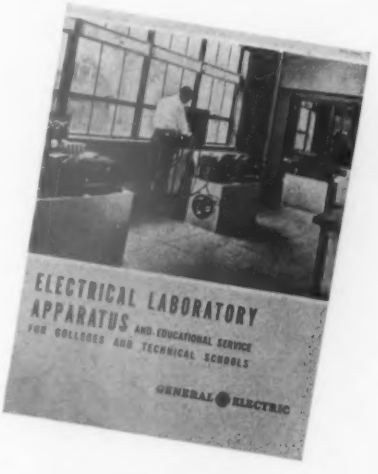
The minimum, or **Group C,** equipment is suggested as the starting minimum for schools planning technical courses. It will, in most cases, meet the minimum requirements for State approval of technical high schools in small communities. If the full amount of money is not available at the start, the elementary equipment can be purchased, and additional items required for advanced work can be purchased as the class advances.

The group includes sufficient apparatus to care for the simultaneous operation of two classes of from 20 to 25 students each, provided they are of different years or grades. The equipment is selected with a view of affording practical demonstrations of the fundamental theories and laws set forth in textbooks on elementary electricity, magnetism, and electronics. The apparatus is primarily for classes of beginners. A number of shop items and instruments of the types normally used by beginners is included.

★ ★ ★ ★

ELECTRICAL LABORATORY APPARATUS AND EDUCATIONAL SERVICE, BULLETIN GEA-1185

Illustrates and describes G-E laboratory apparatus particularly adapted for use in vocational schools, technical high schools, and colleges. Standard commercial apparatus is usually recommended. Where the cost, size, and power requirements of such standard equipment are prohibitive, alternative apparatus specially designed for the school laboratory usually can be furnished.



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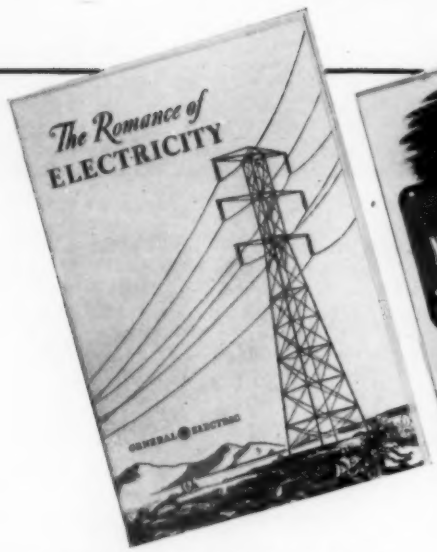
It is not too early NOW to call upon *G-E Advisory Service for Educational Departments* to help you plan your postwar school shop or laboratory

THE AMERICAN SCHOOL AND UNIVERSITY—1945

PUBLICATIONS ★ MOTION PICTURES ★ PHOTO NEWS

General Electric Educational Services



BOOKLETS

The Romance of Electricity, a 56-page story which presents high lights in the historical and technical development of electricity. (GEB-131.)

The Story of the Turbine, a book about the amazing machine that produces America's power on land and on sea. (GEB-129.)

The Story of G-E Research, the history of the first industrial research laboratory and some men who have made outstanding contributions to its advance. (GEB-113.)

Ask for a complete list of publications in this series.

MOTION PICTURES

Exploring with X Rays, a forty-minute sound film, a fast-moving story of X rays from their discovery to recent developments.

Excursions in Science, No. 6, the most recent movie in a series devoted to some notable advancements in the field of science.

Sightseeing at Home, an explanation of television and a visit to our studios showing the actual production of a program.

These films are loaned to schools at no cost. Send for Catalog GES-402J which contains a complete list and description of available films.

POSTERS

Photo News Service, semimonthly news posters giving brief accounts of recent laboratory and manufacturing developments. Published on the first and fifteenth of each month, these posters are now being furnished to some several thousand schools and colleges. The posters are sent free, to teachers only, at their school address.

G-E SERVICES FOR TEACHERS

Bulletin GEB-138 explains in detail the complete General Electric Services for Teachers.

★ ★ ★

Address all requests to Dept. 6–318
GENERAL ELECTRIC CO.
Schenectady 5, N. Y.

ARTIFICIAL OCEAN
The ocean waves may roll, but General Electric naval equipment is thoroughly tested for durability and characteristics in storm and stress by this device. Designed by the Company for development work, this Scorsby tester simulates the roll and pitch of the ocean during the testing of naval equipment. Hats off to the man riding with the equipment — he is risking seasickness!
GENERAL ELECTRIC
PHOTO NEWS SERVICE

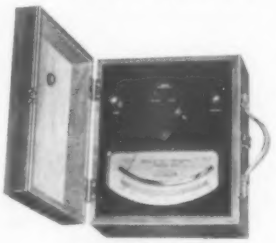
RAWSON ELECTRICAL INSTRUMENT COMPANY

INCORPORATED

98 Potter Street, Cambridge, Mass.

REPRESENTATIVES — Chicago and New York

TYPES 511, 512, 516, 518



Size 8½x9½x6

THE RAWSON COMPANY has been manufacturing the highest grade of electrical and scientific measuring apparatus since 1918. Their meters are of a special double pivot type using the highest grade pivots and sapphire jewel bearings obtainable. Magnetic systems and movements are well aged to attain a high degree of permanency of calibration. Every meter has an individually calibrated scale with mirror and knife-edge pointer for accurate reading. These are the only double pivot meters which can be fitted with an efficient mechanical pivot lifting clamping device.

TYPES 501, 502, 501-A, 504

Size 7¾x7½x4

TWIN MULTIMETER

Size 12"x8"x6"

Meters	Full Scale Ranges	Types	Approx. Scale Length	Accuracy	Approx. Size in Inches	Approx. Base Price of Single Range Meters
* D.C. only. Microammeters, Milliammeters, Ammeters, Millivoltmeters, Voltmeters	2-1000 microamps 1-1000 milamps 1-50 amps 2-1000 millivolts 1-1000 volts	Either 511, 501 or 507	6" 5" 3"	¼ of 1% ½ of 1% ½ of 1%	8½x9½x6 7¾x7½x4 4½x5x3	$110.00 75.00 45.00
* A.C. or D.C. Thermal Milliammeters, Voltmeters	1-1000 milamps 1-1000 volts	512 or 502	6" 5"	½ of 1% ½ of 1%	8½x9½x6 7¾x7½x4	115.00 85.00
Ultra Sensitive, Portable, Semi-suspended Microammeters, Millivoltmeters	.5 to 5 microamps .24 to 10 millivolts	503 503	5"	1%	7¾x7½x6	105.00
D.C. Multimeters	5 current ranges 200 mics to 1 amp 9 ranges on potential 2 millivolts to 1000 volts	501A	5"	½ of 1%	7¾x7½x4	complete 115.00
D.C. Multimeters	5 current ranges 100 mics to 1 amp 8 ranges on potential 5 millivolts to 1000 volts	501C	5"	½ of 1%	7¾x7½x4	115.00
A.C. or D.C. Thermal Multimeters	6 current ranges 10 milamps to 3 amps 8 voltage ranges 300 millivolts to 1000 volts	502 std	5"	½ of 1%	7¾x7½x4	150.00
Twin Multimeter, Combination 501 and 502 Multimeters	27 ranges covering complete 501-A and 502 Std	5012	5"	½ of 1%	12x8x6	175.00
Fluxmeters. Single button zero return	50-0-50 divs. 10000 lines per 1 division with 1 turn search coil	504	5"	1%	7¾x7½x4	125.00
A.C. or D.C. Electrostatic Voltmeters	300 to 5000 volts 6000 to 12000 volts 15000 to 35000 volts	518 518 518	6" 6" 6"	1% 1% 1%	8½x9½x6 10½x11¾x8½ 17x17x15	Base price 150.00 195.00 250.00
A.C. or D.C. Shielded Dynamometer, Milliammeters, Voltmeters, Wattmeters	3 miliamps to 10 amps 1 volt to 1000 volts from 1 watt up	516	6"	½ of 1% or ¼ of 1%	8½x9½x6 8½x9½x6	125.00 137.50

* Multi-ranges and higher voltage ranges can be supplied.

We also manufacture:

Thermo Couples in Vacuo 1.5 milamp to .3 amp and in air .5 amp to 10 amps.

Earth Current Meters for the measurement of electrolysis in buried pipes, shielded cables, mechanical structures, etc.

Remington Arms Company Chronoscopes for the accurate measurement of millisecond periods of time from full scale readings of 2 milliseconds to .2 second.

Reflecting Torsion Galvanometers to measure small transient currents changing at the rate of .01 second or more.

Special electronic apparatus for various purposes to order.

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ATLAS PRESS COMPANY

1890 N. Pitcher St., Kalamazoo 13D, Mich.

INCREASE PRACTICAL SKILLS WITH THESE COMPACT AND ECONOMICAL BASIC MACHINE TOOLS

AMERICAN EDUCATION — after the war — will be challenged as never before to make the most of individual aptitudes.

Parents will insist upon programs that provide every possible opportunity and encouragement to students whose talents are along vocational lines.

In shop classes, this will mean adequate equipment — enough machine tools, for example, so that each student can acquire practical working skills without being held back waiting his turn at a machine.

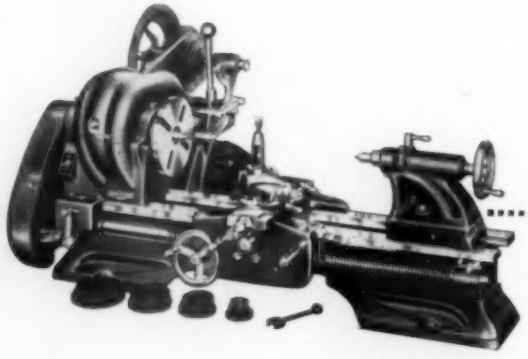
Atlas compact bench tools are ideally suited for classroom work. They encourage precision. They are provided with all operating safeguards. They are made by advanced mass production methods which reduce costs so that more machines can be included in your equipment budget.

SEND FOR CATALOGS

Get the complete story of Atlas capabilities and economy in preparation for the days when diminished war needs permit supplying equipment to you.

WALL CHARTS

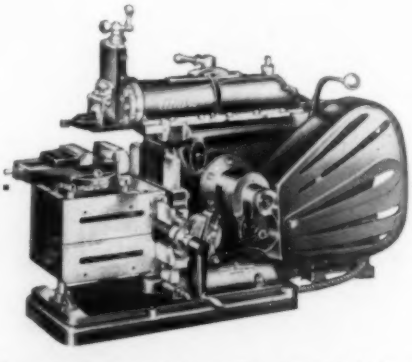
Ideal for lectures or quick reference in the shop. Contain fundamental information about various machine tools and technical data. Complete set of five charts sent postpaid for 25 cents



LATHES — Everything you need for training in lathe operation and care is embodied in Atlas 10" lathes. They are backgeared screw-cutting lathes with automatic cross-feed — designed to maintain precision even though inexpertly used.

DRILL PRESSES — Both bench and floor models are available in normal times. The exclusive Atlas "floating drive" spindle design assures precision work and long service.

MILLING MACHINES — Ideal for quick training in every fundamental milling machine operation without a large investment. Timken bearing equipped. Ruggedly built.



SHAPERS — At low cost these 7" shapers help you provide complete shaper instruction. All the precision and power of large machines built down to scale. Four speeds, five automatic cross feeds.

CANEDY-OTTO MANUFACTURING CO.

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CANEDY-OTTO DRILLING PRECISION BUILT UNITS

C.O. 21" Sliding Head *Motor Driven* Floor Drill

This general-purpose floor drill is an outstanding value for the machine shop: sturdily constructed, full anti-friction bearing equipped, precision built. Spindle, table and base retain perfect alignment throughout years of use. Available with geared power feed and back gears, or with lever feed only. Drilling capacity in cast iron 1½".

C.O. No. 16 Royal Bench Drill *Motor Driven*

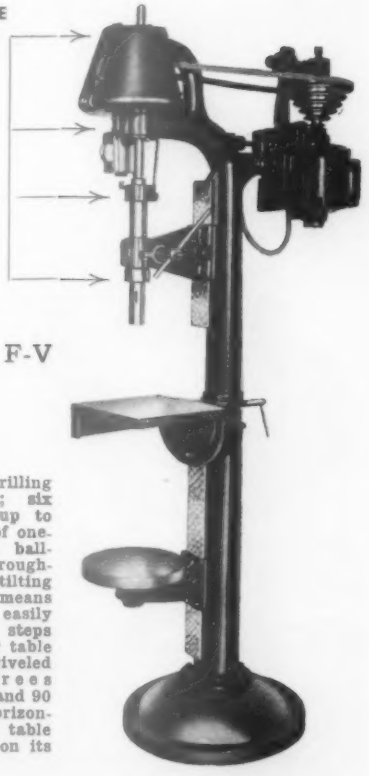
Meets the most exacting requirements, producing accurate work at minimum cost. Primarily designed as a metal working tool, it is also adaptable to woodworking; can be used for sanding, mortising, grinding and routing. Drills holes up to ½ inch, to center of 16¼ inches. Five speeds: 5200-2835-1632-917-460 r.p.m.; with slow speed pulley, 385-732-1240-1950-3110 r.p.m. All ball-bearing equipped.

C.O. No. 18 Royal Floor Drill *Motor Driven*

This general-purpose sensitive drill, also designed for producing accurate work at minimum cost, has drilling capacity in cast iron of ¾-inch with ½-hp. motor, 1800 r.p.m.; ⅞-inch with ¾-hp. motor, 1800 r.p.m.; and 1 inch with ¾-hp. motor, 1200 r.p.m. Six speeds. Full ball-bearing equipment.

Write for illustrated bulletins

4 BALL RACE BEARINGS



C.O. No. 21" Stationary Head "V" *Belt Motor Driven* Drill

This drill is particularly adaptable for automobile repair shops, as the height, distance from spindle to table and base, and general range, permit its use for cylinder reboring of any type or size of internal combustion motor. The brace, or supporting arm, gives additional support and strength for capacity drilling. With the back gear, 8 speeds are obtained. Drills to center of 21" circle, from 0 up to 1½ inches.

C.O. 14" 3000 F-V *6-Speed Sensitive* Floor Drill

This drill has a drilling capacity of ⅝"; six speeds, from 345 up to 3205 r.p.m.; frame of one-piece casting, full ball-bearing equipped throughout; exclusive C-O tilting motor bracket, by means of which the belt is easily changed to various steps of the pulley; upper table capable of being swiveled through 360 degrees around the column, and 90 degrees from its horizontal position; lower table capable of rotating on its axis.

THE CINCINNATI TOOL COMPANY

4061 Montgomery Road, Cincinnati 12, Ohio, U. S. A.

SINCE 1879, strict adherence to high quality in materials and workmanship has made HARGRAVE Mechanic's Tools the standard of excellence in shops the world over. Today, these **"Individually Tested"** Tools are meeting wartime production needs of every type. Illustrated on this page are a few of the many items which we manufacture. **Write for catalog** showing complete line of Clamps, from ¾" opening to 10 feet, and from ½" to 16" deep; also, complete line of alloy steel Cold Chisels, Punches and Star Drills, as well as Brace Wrenches, File Cleaners, Washer Cutters, etc.

SMALL "C" CLAMPS

Strong malleable frames and steel screws. Used extensively in aircraft and many other industries. 1" to 6" openings.

"STANDARD" CARRIAGE CLAMP NO. 540

(Trade Name Registered)

Made of special analysis malleable iron, with hardened steel screw, shaped to give greatest strength for the weight. Openings from 3" to 14".

STEEL SUPERCLAMPS NO. 42 MEDIUM SERVICE

Frame is forged from an extremely stiff steel and heat treated. Screw is hardened steel. Openings from 4" to 18".

SUPERCLAMPS NO. 40 HEAVY SERVICE

Forged Steel

Frame is forged from an extremely stiff steel and heat-treated. Screw is hardened steel. Openings from ¾" to 6½".

IMPROVED SPRING CLAMP

Can be applied or removed instantly. Surface of work is tangent to curve of jaw at any opening. Holds firmly without marring the work. Openings from 1" to 3".

QUICK CLAMPS (Patented)

Especially useful in pattern making, boat and ship building, automobile body, airplane and parlor frame work. The patented clutch will not slip or bind. Always easily released by hand. Openings from 4" to 60", depth from 2" to 9".

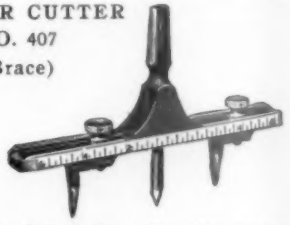
STEEL SPINDLE HAND SCREWS

HARGRAVE Hand Screws are conventional in size and proportions, but have refinements of construction found in no other Hand Screw.

COLD CHISELS

Forged from alloy steel, standard and extra long sizes, from ¼" to 1½" cutting edges. Individually Tested.

WASHER CUTTER NO. 407 (Brace)



Capacity, ⅞" to 6". Used for cutting gaskets from sheet lead, thin wood, leather, paper or rubber, cutting both inner and outer circle at the same time. Used with any ordinary brace.

CAPE CHISEL

Also, Half Round, Diamond Point, and Round Hose Chisels in standard sizes, forged from alloy steel, individually tested.

SOLID PUNCH

Also, Center, Drift, Pin, and Prick Punches, all made from alloy steel, individually tested.

STAR DRILL

All standard sizes, forged from alloy steel and tested.

BRACE SOCKET WRENCHES

Square and hexagon openings, all standard sizes.

IMPROVED "I" BAR CLAMP (Patented)

Bar is high-carbon manganese steel. Slide, Tip, Frame and Crank are best grade of malleable. Improved Wood Grip is protected from breakage by steel cap and ferrule. All-metal handle optional. Openings from 2 feet to 10 feet.

HARGRAVE TESTED TOOLS HARGRAVE

DURO METAL PRODUCTS COMPANY

(MACHINE TOOL DIVISION)

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BEFORE you select the low-cost wood and metal-working machines for your school, laboratory and maintenance shops . . . check carefully into the DURO line.

You will find that DURO machines possess many exclusive advantages and special features — not found in other machines — not even available in heavier, costlier machines.

The DURO line includes a range of Drill Presses, Circular Saws, Band Saws, Scroll Saws, Lathes, Sanders, Jointers, Hand Grinders, Portable Electric Drills and Router-Shaper-Carver Units.

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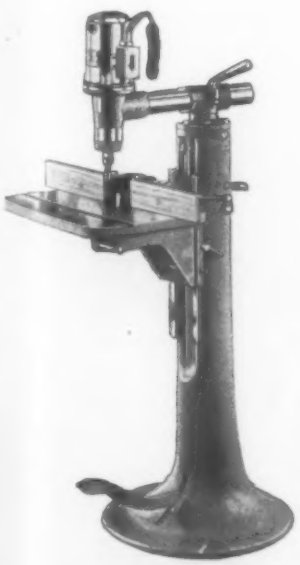
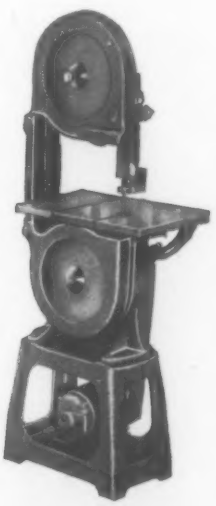
— showing illustrations, full specifications, descriptions and prices of all machines in the DURO line





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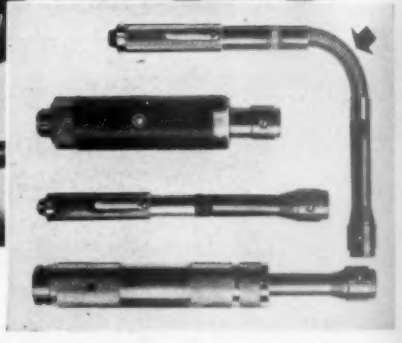
STUDENTS learn *Faster* with *practical* ALL-PURPOSE FOREDOMS!



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Teaching is easier and quicker when your shop courses include the practical instruction of Foredom Flexible Shaft Machines. These versatile all-purpose machines are used successfully in thousands of school shops and plants.

Pencil-size handpieces for the hard-to-reach places and larger ball-bearing handpieces for the heavier jobs are all quickly interchangeable. And flexible shafts which really ARE FLEXIBLE make Foredoms A-1 in efficiency. Because Foredom Machines are employed in so many large and small plants, your students will really benefit from their training with Foredoms when they start their shop careers.

3 WAYS *Right!*

1 **For de-burring, grinding, finishing, polishing and other light production jobs —particularly valuable on irregularly-shaped parts.**

2 **In tool and die departments, for grinding, finishing and touching up dies, molds, jigs, etc.**

3 **For maintenance and emergency needs —touching up set-ups without disassembly, removing high spots on gears, identification marking of equipment, etc.**

THESE SHOP COURSES ALL USE FOREDOMS

Machine Shop Practice, Automotive Mechanics, Aircraft Mechanics, Plastics, Tool and Die Making, Electrical, Radio, Dental Mechanics, Jewelry and Watchmaking, Model-Making, Woodcraft, etc.

THOUSANDS OF PLANTS USE FOREDOMS

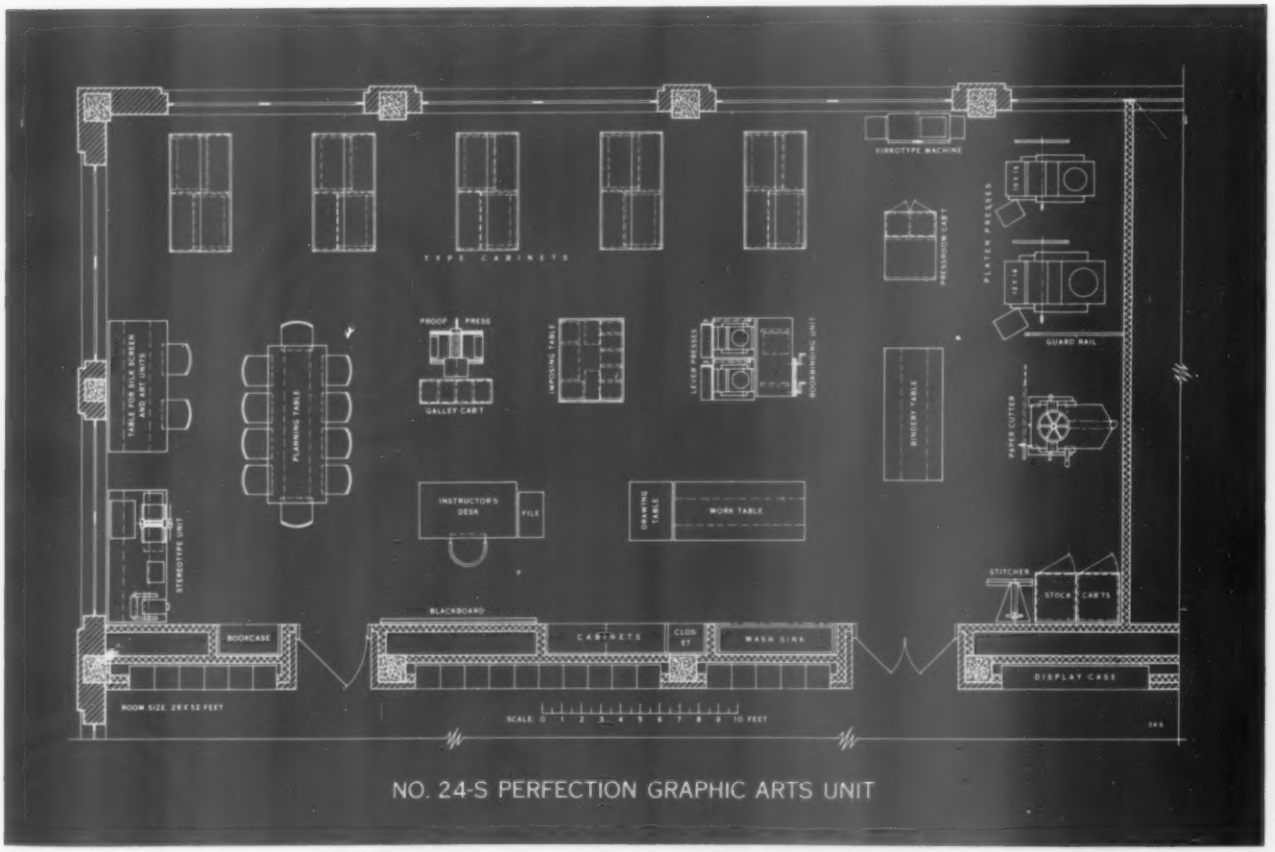
including Ford, General Motors, Chrysler, Nash-Kelvinator, Jack & Heintz, Sperry Gyroscope, Bendix, Westinghouse, etc.

Send for Catalog No. 54, Showing Complete Line and Many Uses of Foredom Flexible Shaft Machines

THE SENIOR HIGH SCHOOL GRAPHIC ARTS DEPARTMENT

No. 24-S
Perfection Graphic Arts Unit

The equipment and supplies listed in this 24-S Graphic Arts Unit will accommodate a class of 24 to 30 students at a time. School Executives, Teachers and Architects will find the information in this folder of value in planning for a Graphic Arts Department in their Industrial Education Program. The recommendations listed in this folder will be of value to the Printing Teacher who plans to modernize his present plant.



NO. 24-S PERFECTION GRAPHIC ARTS UNIT

ATF **American Type Founders** • *Department of Education*

200 ELMORA AVENUE, ELIZABETH B, NEW JERSEY • BRANCHES IN PRINCIPAL CITIES

No. 24-S Perfection Graphic Arts Unit

for Senior High Schools—24 to 30 Students

Composing Room

Five No. 12013-D American Standard School Type Cabinets, steel construction, olive green baked enamel finish; with double-tier working-bank top sloping both ways and two single-tier bodies containing 2 blank cases, 2 Wells two-font cases and 40 California job cases fitted with steel shoes, Presdwood Masonite bottoms, steel cabinet fronts and combination pull and label holders; each cabinet complete with 2 No. 9178-P quarter-size cases for short length leads and slugs; 2 No. 12013-LR lead and slug racks under working top.

Optional Equipment for above Cabinets:

Five No. 12013-LD Locking Devices (one for each tier) for locking all cases (all keys alike).

Five No. BX-12265 Wiring for 2 lights over cases (one for each tier).

Five No. 12013-TX Wiring for 4 lights over top.

One No. 1 Vandercook Proof Press, bed size 16x21 inches, form size 15x17¼ inches; with double semi-automatic grippers, tympan and blanket, 12 drawsheets, 12 undersheets, galley-thickness bed plate, 6-inch Handy brayer frame with 2 bare cores, lock-up pins, 2 deadline bars and necessary tools; complete with following equipment:

One Steel Cabinet with ink plate.

Casting 1 roller for Handy brayer.

One No. 13540 American School Galley Cabinet, steel construction, olive green baked enamel finish; capacity 100 galleys, 8¾x13 inch, in four tiers. Galley openings numbered from 1 to 100.

Optional Equipment for above Cabinet:

Four No. 13540-D Removable Doors with locks (all keys alike).

One No. 13983-X American School Imposing Table, for iron top 51x39 inches, steel construction, olive green baked enamel finish; one side containing unit for labor-saving reglet 10 to 60 picas, unit for labor-saving furniture 20 to 60 picas with drawer at top and unit for 6 each 8x12 and 10x15 chases; opposite side containing unit with runs for 88 galleys, 8¾x13 inch, and 3 bins for empty galleys; one end containing unit with runs for 22 galleys, 8¾x13 inch; opposite end containing unit for five 12x18 chases. Complete with 1 No. 15704 Cast Iron Top, 51x39 inches, 1 No. 3734 Font of Reglet and 1 No. 3744-A Font of Furniture.

Optional Equipment for above Table:

Five No. 13978-D Removable Doors with locks (all keys alike).

One No. 15040-X American School Table, size 96x36 inches, height 30 inches, steel construction, olive green baked enamel finish; with 16-inch lower shelf running full length of table. (To be used as Planning Table.)

Optional Equipment for above Table:

One Presdwood Masonite Top, size 96x36 inches, ¼ inch thick, to be bolted to steel top of table.

One Reliable Stereotyping Unit, consisting of 1 Bench Model Reliable Stereotyper for casting plates up to 8x12 inches, with gas-heated metal pot, electric platen pre-heating units and 1 set of bearers, either type or shell height; 1 Model D Reliable Mat Molding Press, 13½x20-inch bed, with molding blankets; 1 Model D Reliable Mat Scorcher, 9x12-inch heating surface, with electric heat units; 1 Humidor for 12x20-inch mats; 1 package of 25 mill-conditioned Mats, 12x20 inches, and 1 package of 25 sheets gummed Space-Backing Felt.

Optional Equipment for above Unit:

One Auxiliary Bed Plate to equip Model D Mat Molding Press for use as etching press.

One No. 15038-X American School Table, size 80x36 inches, height 30 inches, steel construction, olive green baked enamel finish; with 16-inch lower shelf running full length of table. (To be used for holding Stereotype Unit listed above.)

Type and Spacing Materials

Caslon No. 540

10 pounds	6 point	20 pounds	18 point
40 pounds	8 point	2 fonts	24 point
400 pounds	10 point	1 font	30 point
40 pounds	12 point	1 font	36 point
20 pounds	14 point		

Caslon Italic No. 540

1 font	6 point	2 fonts	14 point
1 font	8 point	2 fonts	18 point
2 fonts	10 point	2 fonts	24 point
2 fonts	12 point		

Caslon Bold

1 font	6 point	2 fonts	24 point
1 font	8 point	2 fonts	30 point
2 fonts	10 point	1 font	36 point
2 fonts	12 point	1 font	42 point
2 fonts	14 point	1 font	48 point
2 fonts	18 point		

Caslon Bold Italic

1 font	6 point	2 fonts	18 point
1 font	8 point	1 font	24 point
2 fonts	10 point	1 font	30 point
2 fonts	12 point	1 font	36 point
2 fonts	14 point		

Bernhard Gothic Medium

1 font	6 point	2 fonts	14 point
1 font	8 point	2 fonts	18 point
2 fonts	10 point	2 fonts	24 point
2 fonts	12 point		

Bernhard Gothic Heavy

1 font	8 point	2 fonts	14 point
2 fonts	10 point	2 fonts	18 point
2 fonts	12 point	2 fonts	24 point

Stymie Bold

1 font	12 point	2 fonts	30 point
1 font	14 point	2 fonts	36 point
2 fonts	18 point	1 font	42 point
2 fonts	24 point	1 font	48 point

Light Copperplate Gothic

1 font 6 point No. 1	1 font 12 point No. 5
1 font 6 point No. 2	1 font 12 point No. 6
1 font 6 point No. 3	1 font 12 point No. 7
1 font 6 point No. 4	1 font 12 point No. 8

Heavy Copperplate Gothic

1 font 6 point No. 21	1 font 12 point No. 26
1 font 6 point No. 22	1 font 12 point No. 27
1 font 6 point No. 23	1 font 12 point No. 28
1 font 6 point No. 24	1 font 18 point No. 29
1 font 12 point No. 25	1 font 18 point No. 30

Brush

1 font	18 point	1 font	36 point
1 font	24 point		

Engravers Old English

1 font	8 point	1 font	12 point
1 font	10 point	1 font	18 point

Linear Alpha-Blox

1 font	12 point	1 font	24 point

Reverse Alpha-Blox

1 font	12 point	1 font	24 point

Spaces and Quads

15 pounds	6 point	30 pounds	24 point
20 pounds	8 point	15 pounds	30 point
140 pounds	10 point	15 pounds	36 point
35 pounds	12 point	10 pounds	42 point
25 pounds	14 point	10 pounds	48 point
35 pounds	18 point		

5 pounds 10 point American Line Leaders, Series 546, 4 dots to the em.

1 pound 10 point Caslon No. 540 Braces and Dashes.

1 pound 10 point Caslon No. 540 Fractions.

½ pound 10 point Caslon No. 540 References.

1 font Handypack Parentheses No. 46.

1 font Handypack Brackets No. 76.

3 fonts 2 point Leads No. 9011-D, 5 to 9½ picas.

3 fonts 6 point Slugs No. 9011-E, 5 to 9½ picas.

5 fonts 2 point Leads No. 12013-F, 10 to 50 picas.

5 fonts 6 point Slugs No. 12013-G, 10 to 50 picas.

1 No. 5 font 2 point Labor-Saving Brass Rule No. 2Br3.

1 No. 5 font 2 point Labor-Saving Brass Rule No. 2Br10.

1 font 2 point Miters for Brass Rule No. 2Br3.

1 font 2 point Miters for Brass Rule No. 2Br10.

1 assortment No. 20 Thin Spaces in Quarter-Size Case.

ATF Printing Art Units

One ATF Handy Ti-Pi Rubber Plate Kit, consisting of complete set of Ti-Pi Engraving Tools, 15-inch nickel plated T-Square, a sharpening pad and set of Ti-Pi Blocks consisting of one each 9x12, 6x9, 4x6, 3x5½ and two 3x5 inch, with complete set instructions for use.

One ATF Linoleum Block Kit, consisting of set of 4 Engraving Tools, 1 Knife, 1 Soap Stone and set of Linoleum Blocks consisting of one each 9x12, 6x9, 4x6 and two each 4x4 and 3x4 inch.

One ATF DeLuxe Silk Screen Unit, consisting of:

One Printing Frame, 16x28 inches inside, covered with No. 12 silk and mounted on 24x36-inch base board, with back bar, drop bar and necessary hardware.

One Printing Frame, 12x18 inches inside, covered with No. 12 silk and mounted on 15x24-inch base board, with back bar, drop bar and necessary hardware.

9 quarts Naz-Dar Silk Screen Process Paste Paint, one each of the following colors:

Toluidine Red	Orange
Strontian Yellow	Purple
Ultramarine Blue	White
Medium Green	Black
Rich Brown	

4 Film Sheets, 11x14 inch.

4 Film Sheets, 14x22 inch.

1 14-inch Squeegee.

1 11-inch Squeegee.

1 quart No-Clog Varnish.

1 quart Film Solvent.

1 quart Stencil Filler.

1 quart Filler Remover.
2 Stencil Knives.
1 jar Protective Cream.
2 Lettering Brushes.
2 Putty Knives.
10 yards Frame Tape.
1 Teacher's Manual.
1 copy "Elementary Silk Screen Printing" by Kosloff.

One No. 15038-X American School Table, size 80x36 inches, height 30 inches, steel construction, olive green baked enamel finish; with 16-inch lower shelf running full length of table. (To be used for Silk Screen and Art Units.)

Optional Equipment for above Table:

One Presdwood Masonite Top, size 80x36 inches, ¼ inch thick, to be bolted to steel top of above table.

Press Room

One 10x15 New Series C & P Platen Press, with single disc, combined gear and pinion guard, straight shaft, 3 semi-steel chases, 6 roller trucks, 6 roller stocks (3 cast) and 2 wrenches; complete with following equipment:

1 C & P Fibre Flywheel Guard.
1 Reliance Platen Guard.
1 C & P Press Brake.
1 New Series Short Ink Fountain.
1 C & P Motor Bracket with belt-tightening adjustment; including pulley.
1 C & P Wire Mesh Belt Guard.
1 Model D Redington Counter.
1 Kimble ¼ h.p. Variable Speed Motor for local current, with Press-O-Matic or wall-mounted control, belt drive; including Endless Leather Belt.

One 12x18 New Series C & P Platen Press, with single disc, combined gear and pinion guard, straight shaft, 3 semi-steel chases, 6 roller trucks, 6 roller stocks (3 cast) and 2 wrenches; complete with following equipment:

1 C & P Fibre Flywheel Guard.
1 Reliance Platen Guard.
1 C & P Press Brake.
1 C & P Long Ink Fountain.
1 C & P Motor Bracket with belt-tightening adjustment; including pulley.
1 C & P Wire Mesh Belt Guard.
1 Model D Redington Counter.
1 Kimble ⅓ h.p. Variable Speed Motor for local current, with Press-O-Matic or wall-mounted control, belt drive; including Endless Leather Belt.

Two Pilot Lever Presses, chase size 6½x10 inches inside, each with standard equipment consisting of single disc, depressible grippers, 1 semi-steel chase, wrench and 2 cast rollers; complete with following equipment:

Two No. 5108-V American School Lever Press Cabinets, wood construction, olive green enamel finish, top 24x24½ inches, height 25 inches; each with drawer for 4 rollers and small tools, chase rack for 4 chases and 2 open shelves for stock and miscellaneous items. (These cabinets to serve as bases for above presses.)

One Simplex Heavy Duty Virkotype Machine, will process paper 12 inches wide; with two 12-inch Globar heating units and motor for local current; including Steel Stand.

One No. 15099 American School Pressroom Cabinet and Stock Table, steel construction, olive green baked enamel finish; with 14 wood interlocking drying racks, compartment for 13 rollers any length up to 29⅜ inches, 3 shelves for inks, rag bin, and drawer divided into 2 compartments and containing ink-mixing tray. Hinged door over ink and roller compartments.

Bindery

One 26½-inch Hand Lever Paper Cutter, Challenge 265 or Chandler & Price Craftsman, with measuring tape, 1 knife and 4 cutting sticks; including following equipment:

1 Two-Handed Safety Lever Control.
1 Additional Knife.

One No. 5 Boston Wire Stitcher, foot power, capacity 2 sheets to ½ inch; with combination flat and saddle table, detachable fibre-head spool and one 5-pound coil of No. 25 wire.

One Sieber Adjustable Hand Punch, with 2 solid round hole dies; including 1 additional solid round hole die.

Two No. 15038-X American School Bindery Tables, 80x36 inches, height 30 inches, steel construction, olive green baked enamel finish; with 16-inch lower shelf running full length of table.

One No. 15055-B School Paper Storage Cabinet, steel construction, olive green baked enamel finish, consisting of 2 No. 15055 Cabinets, bolted together, with Presdwood Masonite Top; each cabinet containing 4 shelves large enough to hold 22x28-inch paper stock, and fitted with hinged door with lock.

ATF Hand Bookbinding Outfit

One ATF-Pratt Hand Bookbinding Unit, consisting of work clamp (maximum opening 6½ inches, width between screws 18½ inches), trimming shelf, drilling jig, drill back stop, set of backing metals and sewing frame board with uprights and cross bar.

One No. 9110-D Bookbinder's Work Bench, wood construction, natural finish; with 48x22-inch maple top, 1¾ inches thick, and drawer for tools and accessories.

One set ATF Bookbinding Tools, consisting of 1 Book Saw, one 2x8-inch Book Trimming Chisel, 1 Backing Hammer, 2 pairs 8-inch Hand Shears, 3 Knives, three 7-inch Paper Folders, 1 12x8-inch steel Square, 1 Hand Drill.

One assortment ATF Bookbinding Supplies, consisting of 1 dozen 1/16-inch Drills, 1 dozen Needles, 3 skeins unbleached Linen Thread, one 2½-lb. cake or 1 quart Bookbinder's Glue, 10 sheets each gray and white End Papers, 30 yards 1¼-inch gummed Cloth Tape, 5 yards Backing Cloth, 12 yards red and gold Head Banding, 12 yards green and gold Head Banding, 1 roll ½-inch Sewing Tape, Binder Board and 2 yards each blue, black, green, red and brown imitation leather Covering.

One No. 00½ Hickok Standing Press, with 10x15½-inch platen.

One No. 401 Sta-Warm Automatic Electric Glue Pot, quart size, for local current; with Copper Container.

One Hickok Lettering Pallet, style No. 1, with 6-inch jaw opening.

Four Hickok Cherry Pressboards, 10x13 inch, brass bound.

One No. 4545 National Card Cutter, 18 inch.

Miscellaneous Items

One Justrite Benzine Can, quart size, without screen.

One Justrite Benzine Storage Can, 3-gallon size, with screen.

One No. 1 Stapleset Benzine Brush, oval back.

Four Semi-Steel Chases for Pilot Lever Press.

Twenty Rouse Pica Composing Sticks, 6x2 inch, stainless steel.

One Rouse Job Composing Stick, 10x2 inch, stainless steel.

One Rouse Job Composing Stick, 15x2 inch, stainless steel.

Two All Brass Job Galleys, 8¾x13 inch, graduated to picas on end and one side.

One All Brass Job Galley, 12x18 inch, graduated to picas on end and one side.

One hundred Pressed Steel Galleys, 8¾x13 inch, non-rust.

One dozen Megill Spring Tongue Gage Pins.

One dozen Megill No. 2 Original Steel Gage Pins.

One No. 2 Rouse Line Gage, 12 inch, graduated to picas, nonpareils and inches.

One quart ATF Tabbing Compound.

One pound Amtyco Printing Ink, in ¼ 1-lb. tubes, assorted colors.

One No. 604, Style B, Square End Ink Knife.

One No. 30 American Lead and Rule Cutter, capacity 105 picas.

Two Model 5 American Blue Boy Typographic Numbering Machines, 5 wheels, with slide plungers.

One No. 3 Justrite Oily Waste Can, with foot lever.

One quart Makeready Paste.

One dozen No. 1 Challenge Quoins.

One Style C Challenge Quoin Key for No. 1 Quoins.

Two pairs 10-inch Steel Roller Supporters.

Two pairs 12-inch Steel Roller Supporters.

One Perfection Tableting Press, consisting of sheet steel holder, clamp and 6 boards.

Five pounds No. 28 Round Wire in coil.

Five pounds No. 21x25 Flat Wire in coil.

Two Model L Prentiss Detachable Head Spools, for stitcher wire coils.

Two No. 3045 Quarter-Size Rule Cases.

One No. 3185 Leader Box.

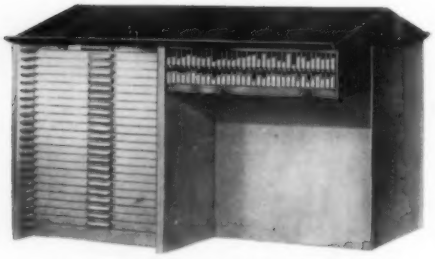
One No. 5805-W Printer's Hickory Mallet, 12 ounce.

One No. 5837 Proof Planer, 3¼x8 inch, with leather top.

One No. 5839 Type Planer, 3¼x6 inch.

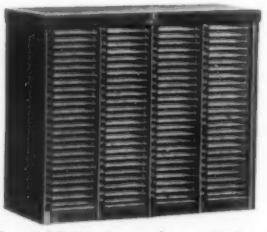
One set "Visual Aids for Instruction in Printing" (24 charts, each 11x14 inches).

Equipment for No. 24-S Perfection Graphic Arts Unit



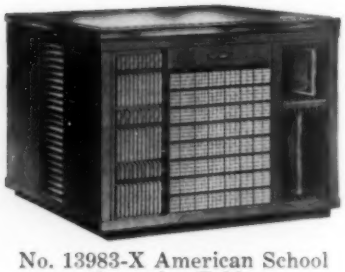
No. 12013-D American Standard School Type Cabinet

No. 1 Vandercook Proof Press

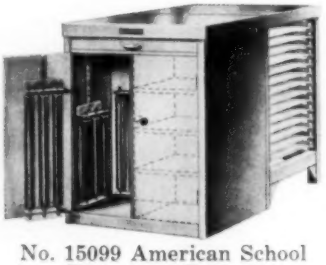


No. 13540 American School Galley Cabinet

Pilot Lever Press and American School Lever Press Cabinet

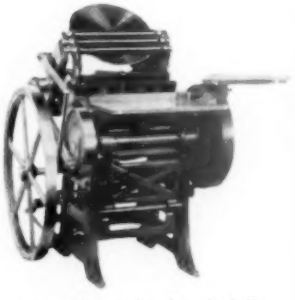


No. 13983-X American School Imposing Table

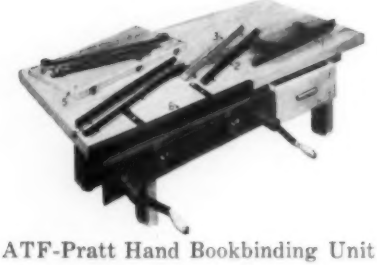


No. 15099 American School Pressroom Cabinet

10x15 New Series C & P Platen Press

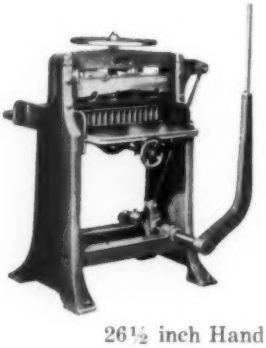


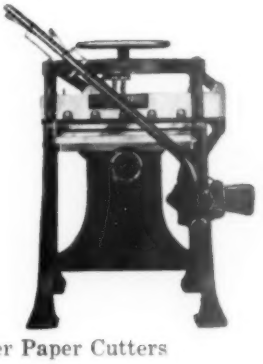
12x18 New Series C & P Platen Press



ATF-Pratt Hand Bookbinding Unit

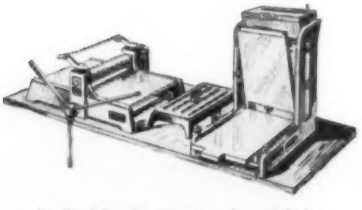
No. 5 Stitcher





26½ inch Hand Lever Paper Cutters

De Luxe Silk Screen Unit



Reliable Stereotyping Unit

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ATF Display Types used: Lydian and Lydian Bold with Italic

Printed in U.S.A. on ATF presses

PORTER-CABLE MACHINE CO.

3000 N. Salina Street, Syracuse 8, New York

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★ *In Peace as in War* ★

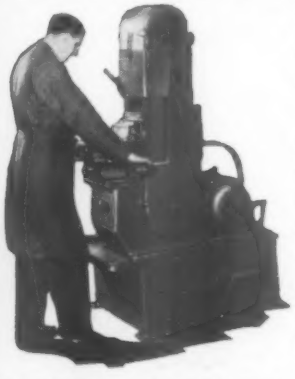
PORTER-CABLE

Will Build the

TOOLS OF INDUSTRY

You who train your students on modern PORTER-CABLE Machines! You make a vital contribution to the war effort. Now education must face the Peace — as effectively as it faced the War. Many concepts will change — many methods will be altered. One procedure will remain — progressive as before — the training of students on the tools that industry prefers. PORTER-CABLE Machines have set a record in war work — operators have attained their highest skills on these modern machines. In the future — as in the past and present — education on these machines serves both the pupil and the general good.

PORTER-CABLE G-8 Wet-Dry Belt Surfacer



If your student knows this modern machining method — he's equipped with the information industry wants! Utilizes high-speed abrasive belt — wet or dry. Operations done free-hand, or with simple fixtures. Surfaces equally well on hard or soft metal, wood fibre, hard rubber, ceramics, or glass. AN IMPORTANT FACTOR IN PLASTICS PROCESSING.

PORTER-CABLE Belt Surfacer, Model B-6

The Machine with the flexible belt — wet or dry — that follows the contours of the piece. Adjustable backing plate for grinding flats. INDUSTRY HAS FOUND HUNDREDS OF NEW USES FOR THIS MACHINE — YOUR STUDENTS SHOULD OPERATE IT.

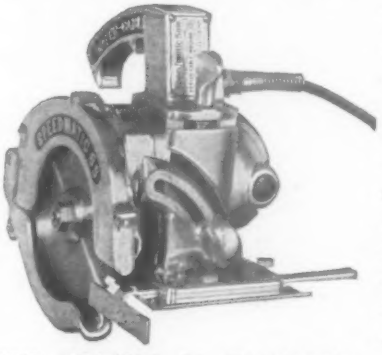
PORTER-CABLE Belt Surfacer, Model G-4

Tool rooms from coast to coast have these models in use. And it also has primary importance in production. Finishes small parts. Many light milling and grinding operations done without fixtures. Slotted table adjustable up to 45°, for machining angled surfaces. TRAINING ON THIS MACHINE IS A BASIC REQUIREMENT IN METAL WORKING.

TAKE-ABOUT THE DUSTLESS SANDER

Those students of yours who are looking toward the wood-working industry — they'll need to be expert sanders. No machine will enable them to sand so fast, so easily, or so accurately as this TAKE - ABOUT, the sander that is already acclaimed by more than 4,000 leading schools. FOR CLASSROOM OR REPAIR WORK — EVERY SCHOOL NEEDS THE TAKE-ABOUT.

Speedmatic SAWS



The portable electric saw is the one concrete piece of equipment which points toward a mass - produced, lower-cost tomorrow. High-speed, 11% more power efficiency, one - hand operation, true - balanced light - weight, sturdy helical gear drive. TEACH TODAY THE METHODS OF TOMORROW. SPEEDMATIC SPELLS PRODUCTION.

Speedmatic FLOOR SANDER

Whether used for teaching floor-sanding — or for maintaining school floors, the high-speed drum, extra-powered motor, feel-of-the-floor adjustment, and high-vacuum dust collection of SPEEDMATIC make it the choice of knowing professionals. SPEED WITH EXACT CONTROL — EFFICIENCY WITH EASY-TO-LEARN OPERATION. TRAIN ON THE MACHINES OF INDUSTRY.

WRITE NOW FOR COMPLETE INFORMATION ABOUT THE TOOLS THAT WILL
Build the Peace

PORTER-CABLE Machine Co.
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Please send me without obligation descriptive matter on Porter-Cable machines indicated below:

☐ Wet-Dry Belt Surfacers ☐ Speedmatic Floor Sanders
☐ Take-About Sanders ☐ Speedmatic Saws

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SKILSAW, INC.

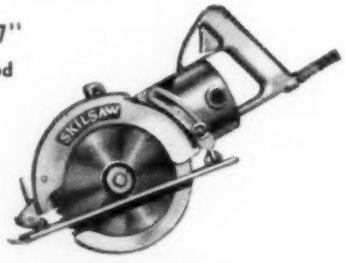
Chicago 30, Illinois

Manufacturers of Portable Electric SkilTools

There is a Portable Electric SkilTool to speed up every sawing, drilling, sanding or grinding job. Manual training and shop students turn out finer work, are better fitted for jobs in industry, carpentry, aviation maintenance, and other fields, when they learn with SkilTools. School maintenance men appreciate the time and labor saving possible with these modern tools on such typical jobs as refinishing tables, desks, lockers, resurfacing blackboards, etc. Ask your regular school supplies distributor for a copy of the latest, complete catalog on SkilTools — no obligation.

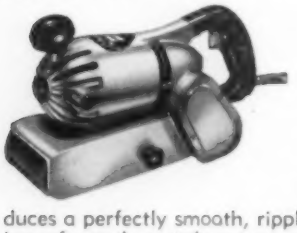
SKILSAW MODEL "77"

Cuts 2⅜" Deep in Wood



One of several models available, Model "77" is the greatest value among 7¼" saws. Crosscuts 2" rough lumber, bevel-cuts 2" dressed lumber at 45°. Quick adjustment for both depth and bevel cutting. Fast in cutting metals, stone, concrete, tile and many composition materials. Maximum cutting capacity in wood 2⅜". Base adjusts vertically from ¾" to 2⅜". Automatic telescoping guard shields saw blade when not cutting. Length overall 17¼". Net weight 15 lbs. Equipped with one combination blade; 10 ft. of 3-conductor cord and connector; steel permanent carrying case; wrench; lubricant. Standard voltage 115, D.C. or A.C.

MODEL "77" ..... **each $105**



BELT TYPE SKILSANDER MODEL "ZP"

3" Wide Belt

Compact, streamlined, perfectly balanced, the ideal sander for manual training students or school maintenance work. Produces a perfectly smooth, ripple-free finish . . . speeds all sanding of wood, metals, stone and composition materials. Belt easily removed or centered. Momentary contact trigger switch for safety. Free belt speed 1200 ft. per minute. Size overall 4¼" x 13¼" x 7" high. Net weight 13¼ lbs. Equipped with resilient backed metal pad; 10 ft. of 3-conductor cord and connector; medium grade SkilSander Belt; lubricant. Standard voltage 115, D.C. or A.C.

MODEL "ZP" ..... **each $88**

DISC TYPE SKILSANDER MODEL "G"

7" Heavy Duty

This tool is ideal for grinding down welding beads, removing scale from castings, etc. Used with sanding discs, wire cup brushes, cup grinding wheels and other accessories to handle every sanding or grinding job. No-load speed 3600 R.P.M. Length overall 16¾" not including pad. Net weight 12½ lbs. Equipped with 10 ft. of 3-conductor cord and connector; detachable handle; tool rest; 7" pad; 3 sanding discs, wrench. Standard voltage 115, D.C. or A.C.

MODEL "G" ..... **each $73**

SKILDRILL MODEL "80"

½" Special Duty

Only 11½" long overall—3½" wide — compact, streamlined Model "80" is ideal for use in close quarter work where the usual ½" drill cannot get in. Just right for maintenance drilling. Powered for constant production work on metals. Capacity in steel, ½"; in hard wood, 1¼". No-load speed 450 R.P.M.; full load 300 R.P.M. Equipped with ½" capacity 3-jaw Jacobs chuck and key; 7 ft. 3-conductor cord and connector; detachable pipe handle. Standard voltage 115, D.C. or A.C.

MODEL "80" ..... **each $48**

SKILDRILL MODEL "64"—⅜" Heavy Duty

Perfect for production or maintenance drilling of ⅜" holes in all metal. Like Model "80," excellent on close-quarter drilling. Capacity in steel ⅜"; in hard wood 1". No-load speed 750 R.P.M.; full load 475 R.P.M. Net weight 8 lbs. Length overall 11¼". Equipped with ⅜" capacity 3-jaw Jacobs chuck and key; 7 ft. 3-conductor cord and connector, detachable pipe handle. Standard voltage 115, D.C. or A.C.

MODEL "64" ..... **each $48**

SKILDRILL MODEL "45"

¼" Constant Duty

SkilDrill puts a world of drilling power right in the palm of a man's hand . . . for fastest drilling in even the tightest spots. Only 6⅝" long. Weighs just 2¾ lbs. Ideal for aircraft, automobile, refrigerator, radio, tank and other drilling. Capacity in steel ¼"; in hard wood ½". No-load speed 1800 R.P.M.; full load 1050 R.P.M. 2500, 3500, 5000 R.P.M. no extra cost. Slow speeds 500, 750, 1000 R.P.M. $5.50 extra. Equipped with ¼" 3-jaw Jacobs chuck and key; 7 ft. 3-conductor cord and connector. Standard voltage 115, D.C. or A.C.

MODEL "45" ..... **each $32.50**

SKILDRILL MODEL "47"—¼" Heavy Duty

Similar to Model "45" but *even more powerful . . . even greater drilling speed under load.* Capacity in steel ¼"; in hard wood ½". No-load speed 1800 R.P.M.; full load 1270 R.P.M. 2500, 3500, 5000 R.P.M. no extra cost. Slow speeds 500, 750, 1000 R.P.M. $5.50 extra. Net weight 3¼ lbs. Length overall 7¼". Equipped with ¼" capacity 3-jaw Jacobs chuck and key; 7 ft. 3-conductor cord and connector. Standard voltage 115, D.C. or A.C.

MODEL "47" ..... **each $36**

BRANCHES IN ALL PRINCIPAL CITIES

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2245 Berckman St. Plainfield, N. J.

Machine Tools for Metals, Plastics and *Other Materials*

Drill Presses · Radial Drills · Metal-Cutting Band Saws · Metal Cut-Off Machines
Motor Grinders · Flexible Shaft Machines

Walker-Turner Machine Tools are practical industrial production machines, ideally suited to school and vocational training because their efficient, simplified design makes them easy to operate, therefore more quickly mastered by beginners. Each machine is compactly constructed—amply safeguarded—accurate in operation.

Because of the huge demand for metal working tools in schools and war plants, the famous line of Walker-Turner Woodworking Machines has been discontinued for the duration. The following pages give details on Walker-Turner Machine Tools for Metals and Plastics. Our large facilities are concentrated on 24-hour production of these machines, bringing the prices within reach of school budgets and permitting prompt shipment for your war training program.

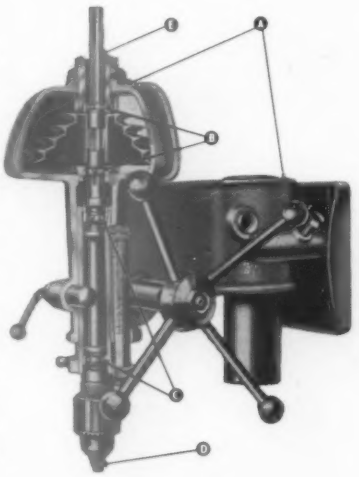
WALKER-TURNER DRILL PRESSES

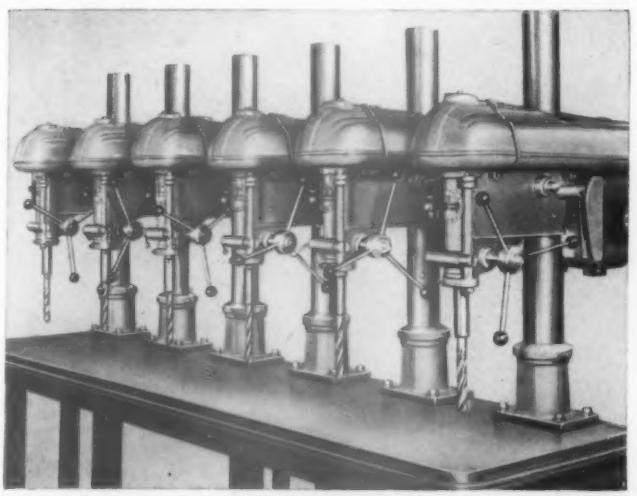
These 15″ Drill Presses are available in several bench and floor models, all incorporating the efficiently designed Drill Head features shown at the right, which provide highly accurate spindle operation. Made of finest materials, built to precision standards, Walker-Turner Drill Presses are easily operated, stand up under continuous use.

SPECIFICATIONS: Standard spindle speeds, with 1740 r.p.m. motor, 600, 1250, 2440 and 5000 r.p.m. Calibrated depth stop, positive locking device, 4-spoke pilot wheel feed, columns precision ground. Spindle travel, 3⅝″. Chuck to table, 12″; chuck to column, 7½″; drills to center of 15″ circle. Bench model, 39½″ high, 10″ wide, 25″ deep. Floor models, 69″ high, 25″ deep. Foot feed available.

DRILL HEAD CONSTRUCTION

A. One-piece head casting, precision bored to assure correct bearing alignment.
B. Bearings above and below drive pulley take strain evenly, eliminating spindle "whip."
C. Precision deep-groove bearings, with thrust taken by upper bearing.
D. Jacobs chuck for maximum accuracy.
E. A few drops of oil placed in cap will lubricate entire spindle and all four bearings. Lowest bearing sealed against dirt, dust and particles.





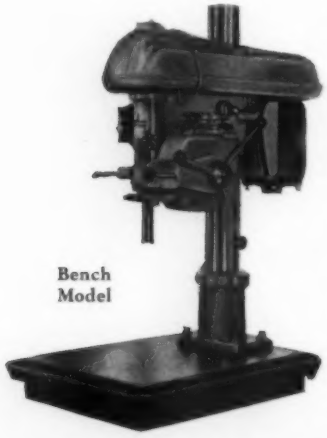
MULTIPLE SPINDLE MODELS (Right)

Walker-Turner Drill Presses are available in 2, 4 and 6 spindle models. Shown herewith is a battery of six 20″ Drill Presses in line for group operation.

20 inch POWER FEED DRILL PRESSES

These drill presses have a compact, smooth-acting power feed unit, driven from the drill press spindle. It operates with a clutch and engages at any point, regardless of spindle position. An automatic, positive release assures holes of uniform depth. Adjustments are quickly made. Operator simply pushes the convenient lever, and drilling or tapping operation completes itself automatically.

May also be operated by the hand feed, which provides sensitive control. Especially valuable for beginners, trainees and inexperienced help. Walker-Turner 20″ Power Feed Drill Presses are available in bench, floor and four spindle models.



Bench Model

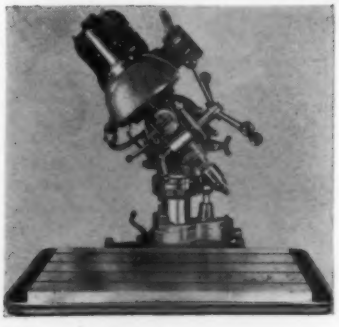
SPECIFICATIONS

Drills to the center of a 20″ circle. Drills holes up to 1″ in cast iron. ¾″ in steel. Four feeding speeds: .003″, .006″, .009″ and .012″ per spindle revolution. Drilling speeds from 260 to 5200 r.p.m. Spindle travel, 6″. Distance spindle to column, 10″. Column, 3¾″ diameter. Ten spline spindle. SKF bearing equipped.

Floor Model

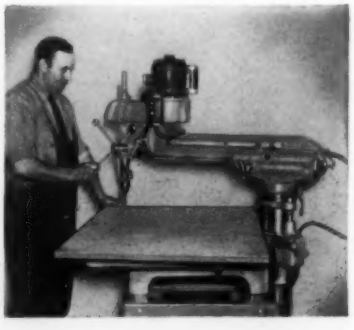
RADIAL DRILL

An extremely versatile, speedy, accurate Radial for drilling, tapping, routing and light profiling. Does much of the work of radials costing 5 to 6 times as much. Very easily operated, its accuracy is well within all industrial and commercial tolerances. Drill head, ram and cradle are raised and lowered by crank-operated screw mechanism at top of column. Overall height, with base, 68½″ maximum traverse of ram, 18″. Distance nose of chuck to table, 16½″. Sixteen spindle speeds from 160 to 8300 r.p.m. with 1740 r.p.m., ½ H. P. motor. Jacobs Chuck, 0 to ½″ or No. 1 Morse Taper. Machined Table surface, 28″ x 19″.



Left: **Head tilts 45° right or left**

Right: **Showing wide range, which permits drilling to center of 62″ circle**

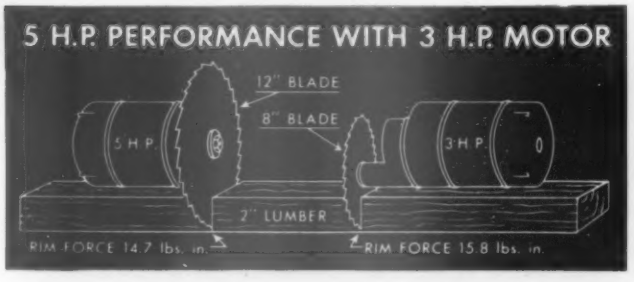


METAL CUT-OFF MACHINE

This machine utilizes the "transverse travel" method, which permits cutting wide, flat materials, bulky pieces and many different shapes of ferrous and non-ferrous metals, ceramics and plastics. Gliding ram mounted on 8 precision ball bearings provides finger-touch control. Head operates in many positions, affording wide usefulness. Height, with steel stand, 61″; floor space 4 ft. x 5 ft.; ram travel, 21½″; vertical adjustment, 8½″; working table, 17″ x 45″.

PATENTED, GEARED, SHOCKPROOF MOTOR

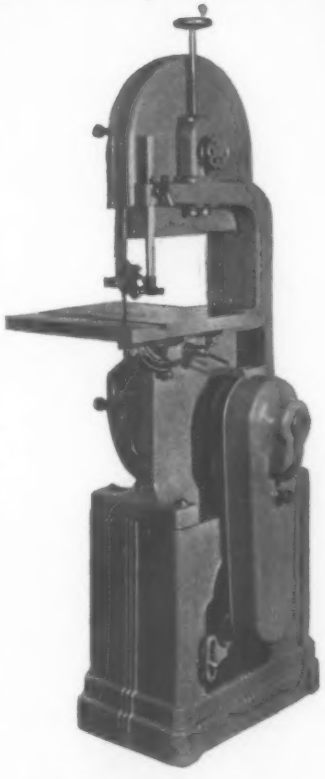
This motor gets the shaft closer to the work, thus smaller wheels, with greater rim force, may be used.



This also permits the use of smaller motors, giving 5 H. P. performance with a 3 H. P. motor. The motor has a "mechanical cushion" in the gears, to protect gear teeth against breakage under shock loads. Automatic resetting.

METAL-CUTTING BAND SAWS

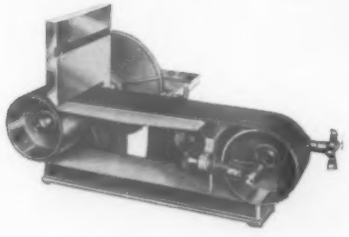
These Band Saws have back-gearing and cone pulleys, similar to those on a screw-cutting lathe, providing wide speed range for cutting or trimming die steels, ferrous and non-ferrous metals, wood, plastics, almost any material. Widely used throughout the war industries. Blade tensioning devices minimize blade breakage. Guards completely protect operator. Heavy cast - iron, one - piece frame for extra strength and rigidity. Available in 14″ and 16″ models.



SPECIFICATIONS

Speed range from 60-5300 f.p.m. Dimensions: 16″ MODEL, overall height, 71½″, width, 30½″, distance front to back, 22″, table size, 17″ x 18″, blade to frame, 16″, guide to table, 12″. 14″ MODEL, overall height, 65″, width, 25¾″, distance front to back, 20″, table size, 16″ x 16″, blade to frame, 14″, guide to table, 7″. Tables tilt 45° one direction, 5° the other.

BELT AND DISC SURFACER



This handy, two-in-one machine has a sanding disc 10″ in diameter and a sanding belt 4″ x 52½″. Belt tension is varied by a cushion spring control. The sanding table under the upper section of the belt is 12″ x 4¼″. The 12″ x 6″ disc table tilts from 90° to 45°. Belt operates at 1050, 1760 and 3100 s.f.m.; disc at 765, 1350 and 2275 r.p.m. Available in table and floor models.

JOINTERS

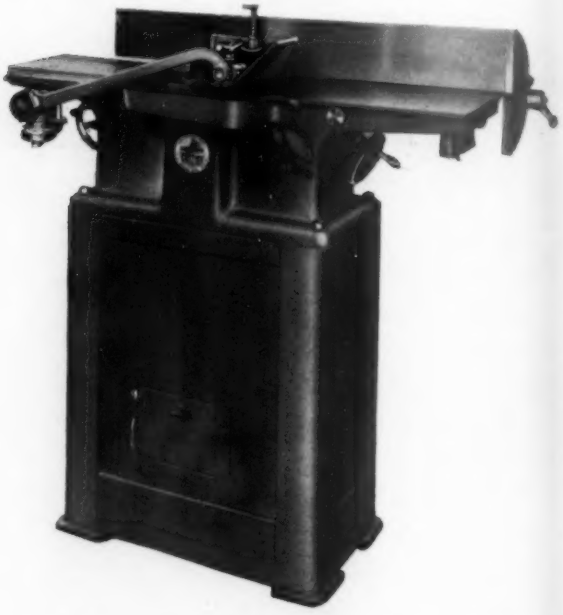
On ordinary jointers, the guard simply swings over the knives for protection. But the guard on this 6″ De Luxe Model Jointer performs a double function. It has been so designed that the work may be fed under it while the operator's left hand, resting on the guard, applies the necessary amount of pressure. Wood can be planed down to ribbon thickness, with absolute safety. And, by feeding the strip between the fence and the curved, inner edge of the guard, thin narrow strips may be planed down to practically nothing.

Texrope drive with triple V belts permits highly efficient, close-coupled motor connection. Hinged fence is equipped with quick-action release lever. Heavy, accurately machined table mounted on dovetail ways with adjustable gibs. Approved 3-knife cutterhead.

TILTING ARBOR SAW

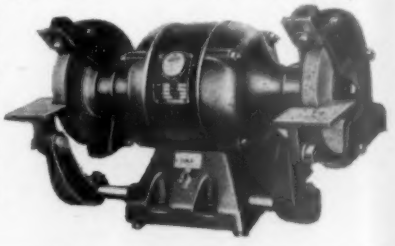
For greater utility and convenience this 10″ Tilting Arbor Saw incorporates several exclusive features. A magnetic overload protection switch positively eliminates injury to motor due to overloading. The Vernier adjustment of the ripping fence is regular equipment. Convenient fence locking lever releases or locks the ripping fence in less than a half turn. The gun-type elevating mechanism is simple and strong and can not be jammed.

New tilting assembly, perfectly balanced and so designed that it can not be sprung or twisted out of alignment. Full 3″ depth of cut, angle cuts to 45°; through 2″ stock on level table. Plenty of room in front of blade. A sturdy, accurate, dependable shop tool.



MOTOR GRINDERS

Motors in these grinders are totally enclosed with special shaft seals to prevent abrasive dusts from damaging vital parts. Precision, dust sealed ball bearings are used. Standard models operate at 2450 r.p.m. Model GR50 ½ H.P. Grinder, shown at the left, has table and stand of cast iron. Table is 18″ x 14″, with cooling cup at front center. Tool tray on either side of cup. Stand adjustable 12″ up or down. Wheels are 7″ in diameter, 1″ wide, ⅝″ hole. Guards designed to latest safety code requirements and have large, non-shatterable glass shields. Guards removable for buffing operations. Uses wheels 6″ in diameter, ¾″ wide, with ½″ hole. Has tool rests adjustable two ways, guards with covers on outside of wheels, sturdy 10 amp. switch and 10″ cord and plug.



Walker-Turner Machine Tools are stocked by distributors in all principal centers, who will be glad to give you full information on any machines or to demonstrate them in their showrooms. Write for name of nearest distributor. Complete catalog of Walker-Turner Machine Tools sent upon request.

BROWN & SHARPE MFG. CO.

Providence 1, R. I.

"World's Standard of Accuracy"

CONVENIENT, VERSATILE MACHINES OF PRECISION CONSTRUCTION

MILLING MACHINES

Universal — Plain — Vertical
including toolroom and
manufacturing types
(No. 2 Light Type Universal shown)

GRINDING MACHINES

Universal — Plain — Surface
—Cutter and Tool
(No. 2 Universal shown)

SCREW MACHINES

Automatic
—Wire Feed (Semi-Automatic)
(No. 2 Wire Feed shown)

Detailed Specifications on machines of any size or type sent on request

THE R. K. LeBLOND MACHINE TOOL CO.

Cincinnati 8, Ohio

Largest Manufacturer of a Complete Line of Lathes

Super Regal

8-Speed Geared Head Lathes

Six Sizes: 13, 15, 17, 19, 21 and 24-inch Swings

FOR LOWER INITIAL INVESTMENT

Regal Lathes are built with all the care and precision that characterize all LeBlond products. They follow the general plan of the LeBlond heavy duty lathes, and retain many important heavy duty features.

Other features are designed to perform less stringent duty; to be lighter in construction for greater ease of manipulation; and to reduce the cost of the original investment. Used for the work for which they are built, these Regal lathes assure the same long, useful service as their heavier companions. They are available with standard floor legs, or with bench legs.

FEATURES

New Rapid Speed Selector

Selective Geared Headstock — 8 speeds — steel gears throughout — reverse to leadscrew, feed rod and compounding gears entirely within headstock.

One-piece Apron — box type — rack pinion and hand-wheel on ball bearings—moving parts submerged in oil.

Geared Feed Mechanism — fool-proof — with both leadscrew and feed rod—automatic resetting safety device prevents undue strain on rod and feed mechanism—tumbler gears and swinging plates eliminated.

Bed — inverted V type — exceptionally heavy — cross girths at close intervals to resist twist and torsional strains.

GAP BED TYPE

In many instances it is necessary to use a large lathe to swing a piece of work—while the actual machining operation can be handled by a lathe of smaller swing. For this purpose the LeBlond Regal Lathe (except the 13 and 15 inch sizes) can be furnished with a gap bed. All the improvements and labor-saving devices are, of course, retained.

STANDARD EQUIPMENT

Reversing type motor, vee belt motor drive complete, motor control switch. Also large and small face plates, steady rest, graduated compound rest, tool post, collar and wedge for same, taper spindle sleeve, adjustable thread cutting stop, centers and necessary wrenches, foundation plan, instruction book, lag screws and washers.

SIZE	13-in.	15-in.	17-in.	19-in.	21-in.	24-in.
Swing, in.:						
Over Way ...	13¼	15¼	17¼	19¼	22¼	25¼
Over carriage and Taper Attach. ...	8¼	10	10⅛	12	13⅛	17
Centers, *min. in.	18	18	30	30	36	36
Spindle Speeds:						
Number	8	8	8	8	8	8
Range, r.p.m.†	25-500	25-500	20-425	20-425	14-350	14-350
Feeds:						
Number	48	48	56	56	63	63
Range, in. ...	.0025 to .144		.001 to .125		.0027 to .0333	
Threads, per in..	4 to 224		1½ to 184		1 to 120	
Net Weight with Motor, lbs.**.	1045	1240	1985	2560	4150	4275

* Increasing in increments of 6 inches on 13- and 15-inch and 12 inches on 17-19, 21-24 inch sizes.

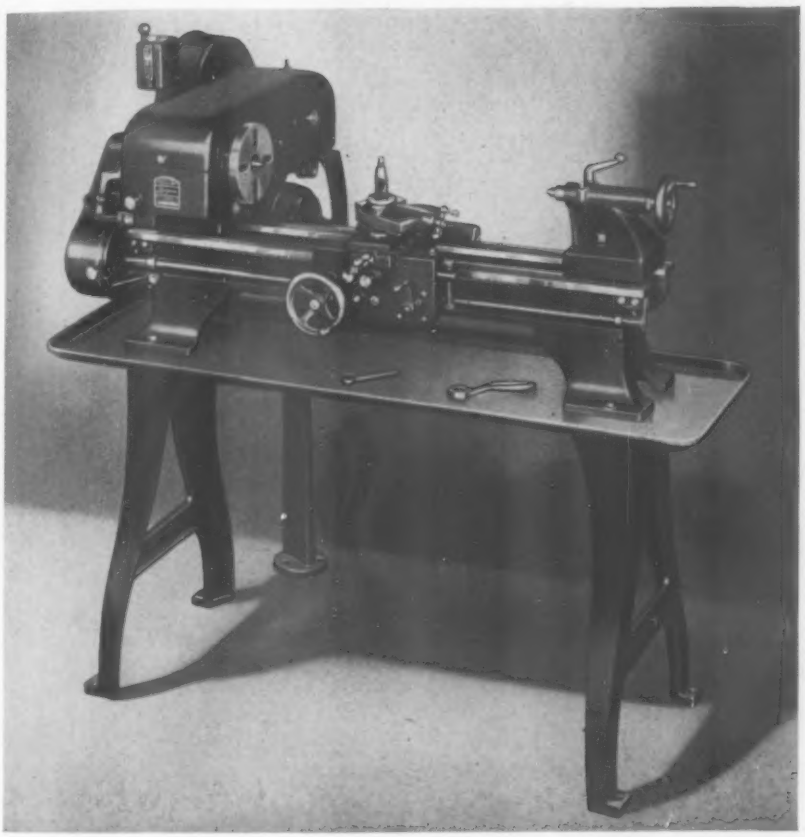
† Speeds shown can be increased 50% for tungsten carbide tools.

** Approximate, with minimum center-to-center dimension.

LOGAN ENGINEERING COMPANY

4901 Lawrence Avenue, Chicago 30, Ill.

Logan A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES



Logan No. 200 Back Geared Screw Cutting Lathe
10″ Swing; 24″ Between Centers

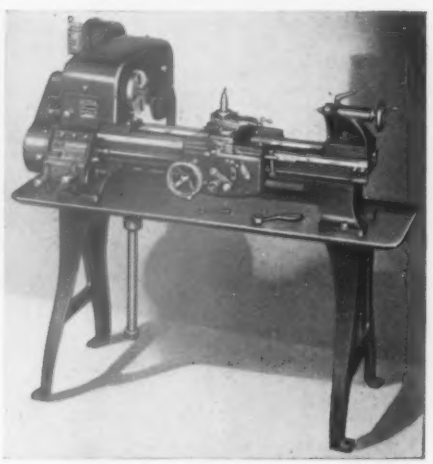
The Logan Line was developed to supply a specific need for a series of fine, high speed production lathes, engineered for sustained accuracy. Advanced design, sound engineering, expert workmanship and rigid inspection, all contribute to their excellence. A comparison of their specifications will reveal many superior features heretofore incorporated only in larger, heavier and more costly equipment. These features include: pre-loaded, precision, grease-sealed ball bearing headstock (bearings require no lubrication or adjustment for their entire life); patented countershaft assembly with three point suspension and rubber mountings to absorb vibration; precision ground ways, two prismatic V ways and two flat ways. The headstock and countershaft are of streamlined design. All pulleys and belts are completely guarded for safety of operation, yet always readily accessible by simply lifting guard.

In addition to the models illustrated, there is also available the Logan No. 830 Hand Screw Machine and the No. 850 Manufacturing Turret Lathe.

Catalog sheets for all models giving complete description and specifications will be furnished on request.

BRIEF SPECIFICATIONS

- Swing over bed .....10½″
- Distance between centers .....24″
- Thread cutting, per inch .....4 to 216
- 12 Spindle speeds....30 to 1450 R.P.M.
- Bed Dimensions .....6 15/16″ x 43⅛″
- Precision, pre-loaded ball-bearing headstock spindle
- Spindle Hole .....25/32″
- Precision ground ways: two prismatic V Ways; two flat ways
- Self lubricating bronze bearings at points on lathe where plain bearings are ordinarily furnished

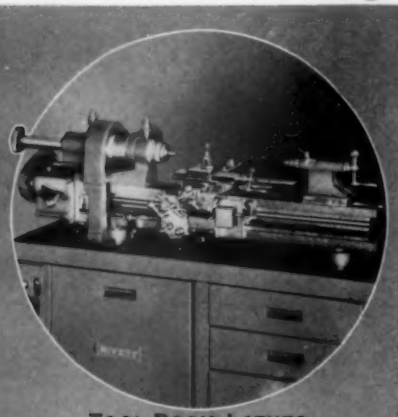


No. 820 Quick Change Gear Lathe

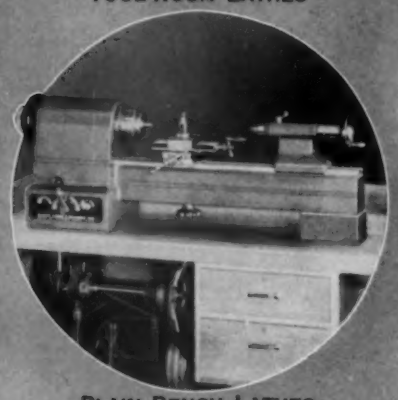
No. 825 Quick Change Gear Cabinet Lathe

RIVETT LATHE & GRINDER, INC.

Brighton, Boston, Mass., U. S. A.



TOOL-ROOM LATHES



PLAIN BENCH LATHES

HAND SCREW MACHINES

INTERNAL GRINDERS

A JOB WELL TAUGHT IS LONG REMEMBERED

Many a fine toolmaker and master mechanic remembers the exacting problems given by his instructor and proudly recalls how he mastered the seemingly impossible tolerances with the aid of a Rivett lathe or grinder. Likewise many a scientist and engineer justly acknowledges the part played by a Rivett machine in his research and new developments. Today these very men rely on Rivett lathes and grinders when the closest precision limits must be maintained. In turn Rivett is proud of the part it has played in training master craftsmen and developing new products.

The first Rivett machine tools were made in 1884, and through the intervening years the builders have sought to perfect their every feature in pace with the progress of the times. Designing has been guided by wide and constant study of the usage in the field, and engineering has availed itself of new production methods and materials. Quality of workmanship has been protected by a group of skilled machinists and assemblers having life-long practice in the making and assembling of Rivett machines.

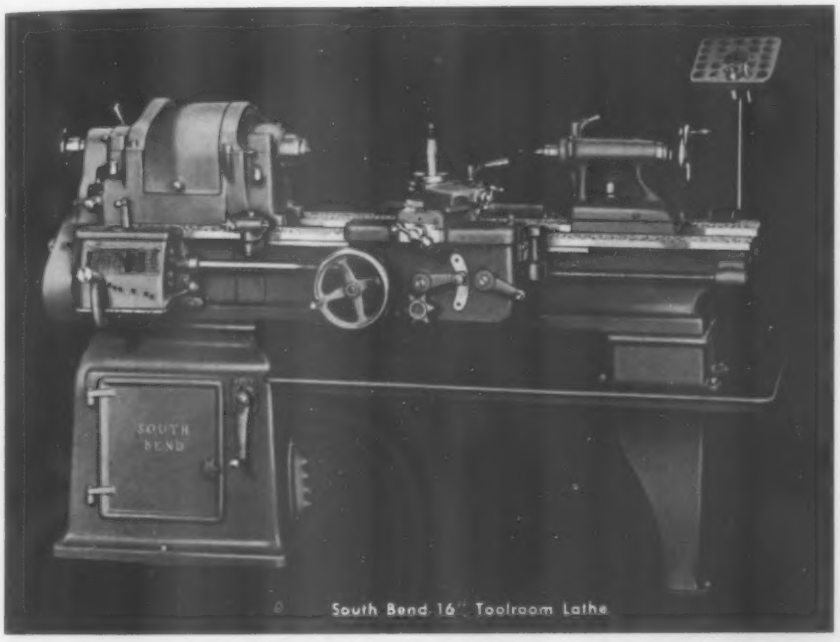
A proper and sound foundation of a machinist's training should include a knowledge of precision tolerances which can so well be taught on a Rivett machine.

Write for General Bulletin 500

SOUTH BEND LATHE WORKS

473 E. MADISON STREET SOUTH BEND 22, INDIANA

Lathe Builders for 38 Years


South Bend 16" Toolroom Lathe

TYPES AND SIZES OF SOUTH BEND LATHES

Engine Lathes and Toolroom Lathes

9" swing—
3', 3½', 4', and 4½' bed lengths

10" swing—
3', 3½', 4', and 4½' bed lengths

13" swing—
4', 5', 6', and 7' bed lengths

14½" swing—
5', 6', 7', 8', and 10' bed lengths

16" swing—
6', 7', 8', 10', and 12' bed lengths

Turret Lathes

Series 900—½" collet, 9" swing
Series 1000—1" collet, 10" swing

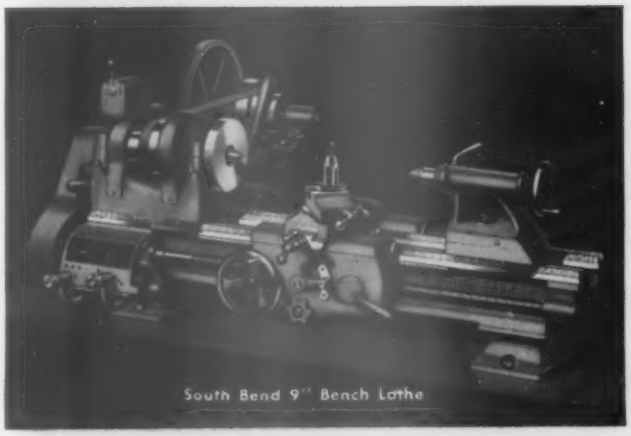
The wide use of South Bend Lathes in industry, for production and toolroom work, makes them highly effective for training purposes. Because students acquire skill on the same lathes they are likely to use in their work, they become better workers in less time.

Their ease of operation, safety features, accuracy, and ruggedness have long made South Bend Lathes popular with both shop instructors and students. There is a South Bend Lathe for practically every type of training from elementary shop to advanced tool and die work. For full information, write for your copy of Catalog 100-D.

South Bend 13" Toolroom Lathe

TEACHING HELPS FOR SHOP CLASSES

To aid the training of new lathe operators, we have made available a comprehensive selection of proven teaching helps. These include books, free loan 16 mm. sound films, wall charts and booklets on lathe operation and care. Full information on obtaining this material can be had by writing for Bulletins 8-A and 21-D.


South Bend 9" Bench Lathe

THE BLACK & DECKER MFG. CO.

Towson, Maryland

BRANCHES IN

Atlanta
Baltimore
Boston
Buffalo
Chicago
Cleveland
Dallas
Denver
Detroit
Indianapolis
Kansas City
Los Angeles

Black & Decker
ELECTRIC TOOL HEADQUARTERS

BRANCHES IN

Memphis
Minneapolis
New Orleans
New York
Newark
Philadelphia
Pittsburgh
San Francisco
Seattle
St. Louis

HOLGUN ELECTRIC DRILL

An all-purpose drill—perfectly balanced, perfectly proportioned, of surprising compactness and smooth, rugged power for heavy duty production work.

Standard Equipment: 2-pole automatic-release trigger switch and locking pin, mounted as a unit with cord protector; 3-wire cable and plug (3rd wire for grounding); 3-jaw Jacobs chuck and key.

Standard Voltage: 110; also available for 220 or 250 volts. Universal Motor.

¼" Std. Holgun	Standard Speed	Low Speed
Capacity in Steel	¼"	¼"
No-Load Speed	1700 R.P.M.	500 R.P.M.
Weight, Net	3 lbs.	3¼ lbs.
Overall Length	6¾"	7⅛"
Spindle Offset	¾"	¾"
Code No.	345	346
Price, complete, specify voltage	$32.50	$38.00
Heavy Duty Holgun—End Handle		
Capacity in Steel	¼"	¼"
No-Load Speed	1700 R.P.M.	500 R.P.M.
Weight, Net	3¾ lbs.	4 lbs.
Overall Length	7¾"	8⅜"
Spindle Offset	¾"	¾"
Code No.	457	460
Price, complete, specify voltage	$36.00	$41.50
Heavy Duty Holgun—Side Handle		
Capacity in Steel	¼"	¼"
No-Load Speed	1700 R.P.M.	500 R.P.M.
Weight, Net	3¾ lbs.	4 lbs.
Overall Length	7⅞"	8⅛"
Spindle Offset	¾"	¾"
Code No.	459	462
Price, complete, specify voltage	$36.00	$41.50

½" STANDARD DRILL

This drill is a full 3½ inches shorter than the previous model, and 2½ pounds lighter in weight. You'll note its perfect operating balance instantly; also the close-coupled construction, minimum spindle offset and horizontal spade handle—all so important when drilling in confined space.

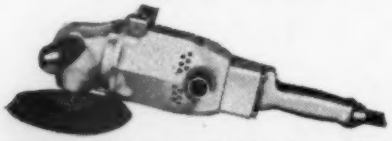
Capacity in Steel, ½"; No-Load Speed, 400 R.P.M.

Net Weight, 10¾ lbs.; Overall Length, 13¾".

Price, complete, specify voltage—(Code No. 361) $53.00

Available for 32, 110, 220 or 250 volts. Universal Motor.

7" STANDARD SANDER



The popular general-purpose Sander for varied shop use.

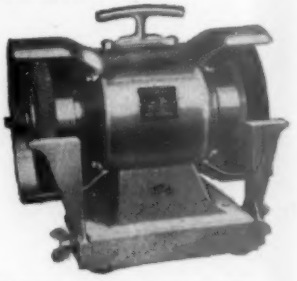
No-Load Speed, 4200 R.P.M.; Net Weight, 12¾ lbs.

Overall Length, 17½"; Pad Diameter, 7".

Price, complete, specify voltage—(Code No. 92) $53.00

ELECTRIC BENCH GRINDERS

6" JUNIOR BENCH GRINDER



A full quality Black & Decker unit with ball bearings throughout, wheel guards, tool rests and convenient handle — unusually low in price.

Wheel Size ..... 6" x ⅝" x ½"

Motor Rating ..... ¼ H.P. Not universal

Price for all 1-phase A.C. voltages and cycles $22.50

6" HEAVY DUTY BALL BEARING BENCH GRINDER

For heavy duty service and longer life this unit is equipped with ball bearings, also enclosed wheel guards, tool rests and handle.

Wheel size ..... 6" x ¾" x ½"

Not universal

Motor rating ..... ½ H.P.

Price for 110 volts, 50-60 cycles, Single phase A.C. voltages only $38.00

All D.C. voltages only 42.00

ELECTRIC PORTO-SHEAR

New, compact, perfectly balanced sheet metal shear for steel, galvanized iron, monel and stainless; copper, aluminum and lead. Easily follows straight or irregular pattern line and cuts to a minimum radius of ¾". Blades are easy to sharpen and adjust for any thickness up to capacity.

Specifications	No. 18 Gauge Porto-Shear	No. 16 Gauge Porto-Shear
Capacity: in Steel (U. S. Std.)	18-gauge	16-gauge
Cutting Speed: No-Load	2500	2500
(Strokes per minute): Full-Load	1500	1500
Weight: Net	5½ lbs.	8½ lbs.
Overall Length	9⅛"	12⅛"
Code No. (specify voltage)	258	259
Price, complete	$60.00	$76.00

VACKAR ELECTRIC VACUUM CLEANER

The No. 95 Vackar is a super-powered cleaner for both automotive and industrial use. With both inlet and outlet hose connections, it can be used as a vacuum cleaner or a blower. Motor and mechanism are completely protected from moisture and unharmed under such use. Ideal all-purpose cleaner for heavy-duty service in garages, shops, factories, etc.

Dimensions: Height ..... 28"
Top Diam. ..... 16¼"
Base Diam. ..... 18½"
Sealed Vacuum Pull ..... 65"
Weight: Net ..... 52 lbs.

Price, complete, specify voltage (Code No. 425) $137.50

Standard voltage 110; also available for 220 or 250 volts.

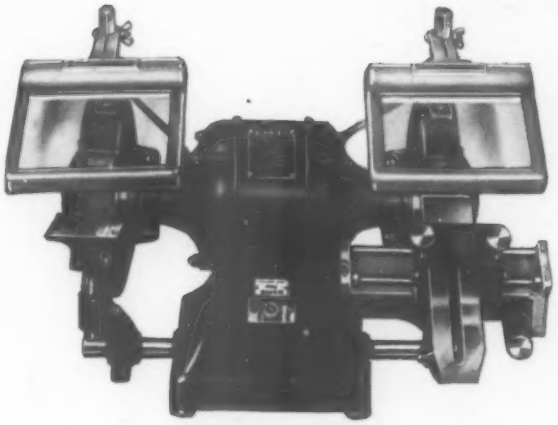
Complete line includes: Drills, Drill Stands, Hole Saws, Screwdrivers, Nut Runners, Tappers, Hammers, Saws, Glue Pot, Bench Grinders, Die Grinders, Portable Grinders, Shears, Sanders, Buffers, Vacuum Cleaners, Valve Shop, Valve Refacers, Valve Seat Grinders, Valve Lapper and Supplies.

COMPLETE CATALOG SENT ON REQUEST.

STANLEY ELECTRIC TOOLS

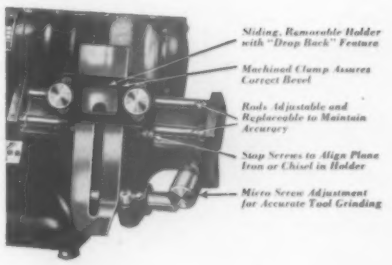
(EDUCATIONAL DEPARTMENT)

New Britain, Connecticut



No. 677 EDGE TOOL GRINDER

Every wood-working shop needs this improved, full ball bearing Bench Grinder. Powered by a ⅓ H.P. induction motor, fully enclosed, it operates at the correct speed for edge tool grinding. Equipped with "Flud-Lite" Eye Shields, one Adjustable Tool Rest, and the Plane Iron and Chisel Grinding Fixtures.

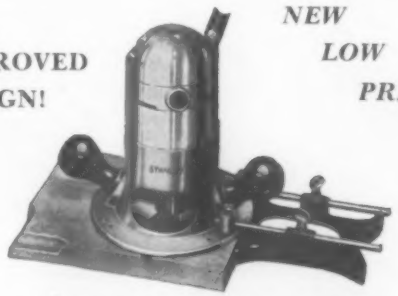

Sliding, Removable Holder with "Drop Back" Feature
Machined Clamp Assures Correct Bevel
Rods Adjustable and Replaceable to Maintain Accuracy
Stop Screws to Align Plane Iron or Chisel in Holder
Micro Screw Adjustment for Accurate Tool Grinding

PLANE IRON AND CHISEL GRINDING FIXTURE

Standard equipment with the No. 677 Grinder, keeps edge tools accurately beveled. Takes plane irons up to 2⅝" wide and chisels of any size. Micro screw feed adjustment.

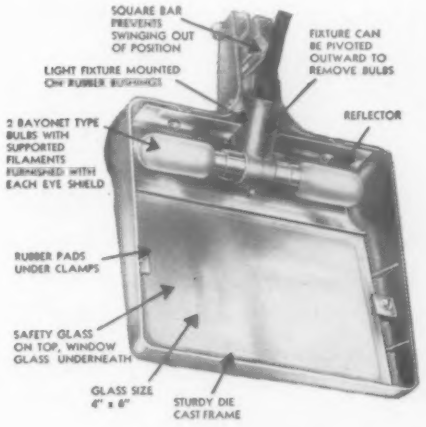
IMPROVED DESIGN!

NEW LOW PRICE!



HAND ROUTER No. 10A

Fast—18,000 R.P.M.—assuring a smooth finish that makes sanding practically unnecessary. For Shaping, Inlay Work, Routing, Templet Work, Veining, Grooving, Rabbeting, Corner Beading, etc. The power unit may also be quickly attached to a Beading and Fluting unit or to a shaper table. Provides a great variety of practical cuts and a wide range of decorative operations at a very low cost.


SQUARE BAR PREVENTS SWINGING OUT OF POSITION
FIXTURE CAN BE PIVOTED OUTWARD TO REMOVE BULBS
LIGHT FIXTURE MOUNTED ON RUBBER BUSHINGS
REFLECTOR
2 BAYONET TYPE BULBS WITH SUPPORTED FILAMENTS FURNISHED WITH EACH EYE SHIELD
RUBBER PADS UNDER CLAMPS
SAFETY GLASS ON TOP, WINDOW GLASS UNDERNEATH
GLASS SIZE 4" x 6"
STURDY DIE CAST FRAME

STANLEY "FLUD-LITE" EYE SHIELD No. 600

Effective eye-protection combined with better vision. Two light bulbs with reflectors floodlight work area, help prevent injuries. Adjustable up and down, and tilts to suit operator's position. Cannot be moved to non-guarding position without dismantling. Standard equipment on No. 677 Grinder. Can be attached to all similar bench or belt-driven grinders.

BE SURE YOU HAVE THESE STANLEY CATALOGS

No. 67 STANLEY ELECTRIC TOOL CATALOG

Describes and illustrates the complete line of Stanley Electric Drills, Saws, Unishears, Grinders and other tools. Write for a copy.

No. 606 ROUTER-SHAPER CATALOG

Describes Stanley Router-Shapers, and all the various attachments and applications. Keep a copy on hand for reference.

STAR PAPER FASTENER CO.

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STAR RED H TWIST DRILLS for School Shop Work

The school shop instructor who is intent on developing real craftsmen must stress accuracy as an adjunct to knowledge and skill. No matter how skillfully made or beautifully finished a project may be, if it is not accurate, it is not the best that can be produced. In fact, a hole inaccurately drilled may ruin a job. Use Star Red H twist drills which are accurately made to do accurate work. Star Red H Drills, made of molybdenum tungsten high speed steel, are a source of satisfaction to the instructor and a challenge to the student to do superior work that is commensurate with their fine quality.

These beautiful tools are produced under ideal manufacturing conditions with constant checks and inspections to assure that every process is up to the required standard.

At present these drills are made in High Speed steel only. Write for the name of our nearest distributor and for more complete information. At the left is shown a set of 29 drills ranging in size from 1/16th to 1/2 inch in diameter. They are packed in a handy drill stand with each size plainly marked. Here is a shop convenience that encourages orderly and careful handling of tools.

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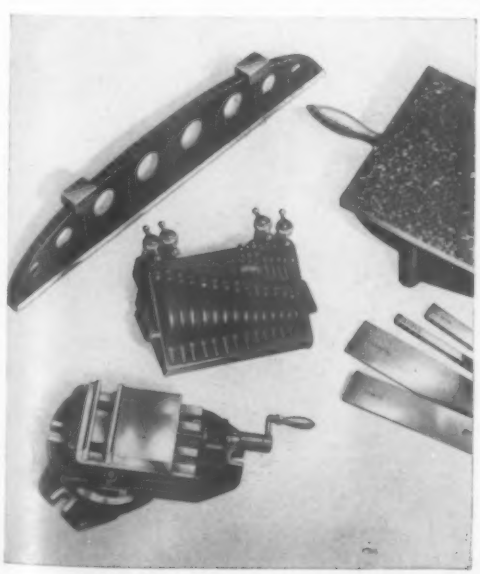

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Choose Millers Falls Tools for school use, and train students in the use of tools which most of industry considers standard.

Available through school shop suppliers everywhere. Write for catalogs.

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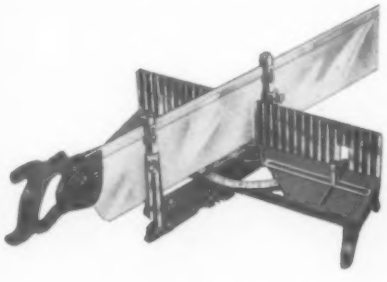

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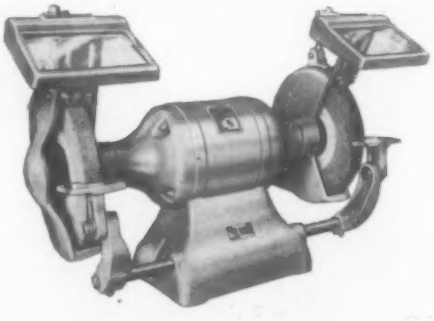

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Finest frames ever made, many sizes and styles. Blades for all uses: Tuf-Flex, general-purpose hand blade, super-tough, super-flexible, cuts thin-walled tubes or tough tool-steel rods without stripping or breaking. Blu-Mol Double-Life, sensational new blade with cutting edges on each side, now in widespread industrial use, should be demonstrated in every school shop.

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STANLEY TOOLS

EDUCATIONAL DEPARTMENT

New Britain, Conn.

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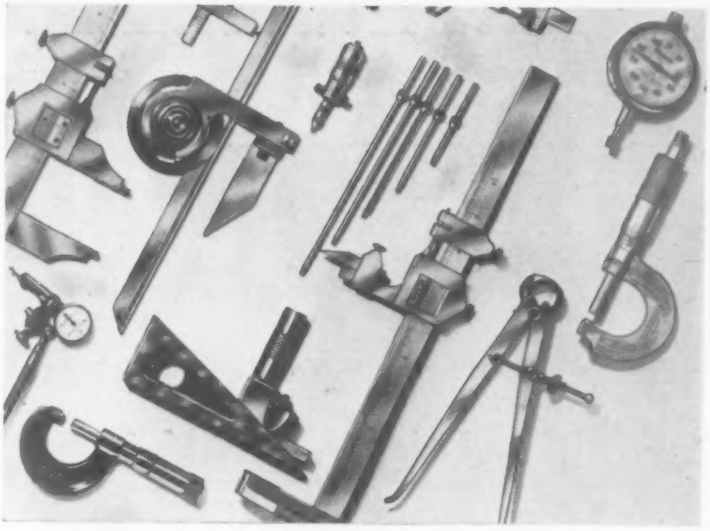

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Scores of instructors are using this book as the handiest source of information budding machinists must have about tools, machines and modern methods. Prepared in cooperation with leading vocational training experts it is written in simple shop language, contains more than 200 illustrations and 30 useful reference tables. Available through your local Starrett Tool distributor at seventy-five cents a copy. Descriptive Folder furnished on request.

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CALIPERS
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"New Britain" Shop Equipment — New Britain, Conn. — *"New Britain" Hand Tools*

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● Call on us now for assistance in planning your post-war building and modernizing projects. This famous Line of School Shop Equipment which has been suspended for the duration to conserve steel will be available again in the future. It will offer many advantages in design and improved construction for the really practical School Shop and Laboratory. Ask us to help you plan your future needs today.

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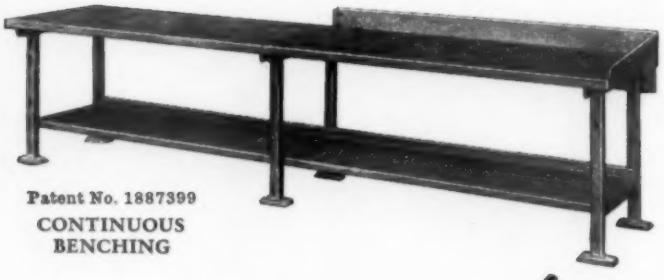

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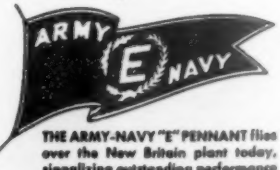
A Complete Line of FINE HAND TOOLS

● More than half a century of precision manufacturing backs this famous Line. Over 1200 standard items including hundreds of specialized Hand Tools the School Shop finds practical and which encourage good workmanship. Ask for the new full line Catalog No. 56M which illustrates and describes these fine Tools in its 15 fully illustrated sections.

New Britain



THE ARMY-NAVY "E" PENNANT flies over the New Britain plant today, signalizing outstanding performance in the production of machine tools, aircraft engine parts and projectiles.

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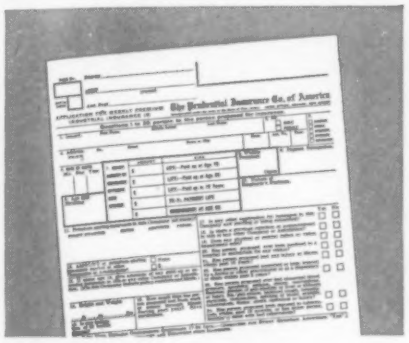

At the Prudential Insurance Company, Newark, New Jersey, applications for industrial insurance are reproduced with Ozalid. The originals are kept on file and Ozalid prints are attached to the policies. Prudential changed their form, adopting a translucent sheet with printing on only one side, so that they could utilize OZALID.

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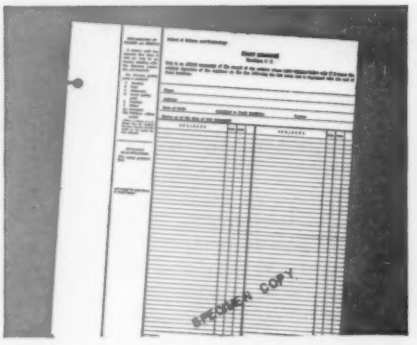

At Pratt Institute, Brooklyn, New York, student records are kept on translucent paper and reproduced with Ozalid—whenever the need arises. Grades are added periodically to the master copy, averages and credits are computed, and the student receives an Ozalid print showing his latest standing. No possibility of errors in transcription this way.

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THE WICKES CONTINUOUS SIMPLEX BLUEPRINTER

Designed and developed to meet the requirements of the small user as well as the larger manufacturing concern. Many of these printers are now being used in schools throughout the country. Moderate initial cost with economical operating cost make the machine desirable and practical for school use. Durable construction will afford protection against hard usage.

Wickes Model D Printer

Operating with one (1) standard mercury vapor lamp. This machine will print up to 250 square feet per hour. Rolls or cut sheets up to 42" wide by any length may be run at a speed ranging from 3" to 24" per minute.

Wickes Model E Printer

Equipped with two (2) standard mercury vapor lamps. This machine will print up to 500 square feet per hour. The speed range is from 6" to 48" per minute, and like the Model D machine, rolls or cut sheets may be printed up to 42" wide by any length.

Both the Model D and Model E machines can be furnished in the table model, as shown in the cut above, or in a floor style cabinet. The floor style cabinet consists of a large storage cabinet which is light-proof and which is ideal for storing chemicals, papers, etc.

In addition to blueprint machines, Wickes Brothers are also manufacturers of special photographic and photocopy machines. These machines are designed for producing photocopies continuously and are available for use in schools desiring the latest in reproducing equipment. Details concerning these machines will be mailed upon request.

Your letter requesting further information, showing your requirements and advising us of the current available, will be promptly answered.

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Aurora, Illinois

AURORA Steel Lockers and Storage Cabinets have been accepted throughout the nation as the Standard for Quality and Workmanship. The growing popularity of our equipment, for the past thirty years, confirms this statement. Installations in America's finest schools.

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Illustrating the 36 x 18 x 78 Inch Storage Cabinet. Larger or smaller cabinets are also available. Can be furnished in combination storage and wardrobe or wardrobe cabinets only. Standard finish, Olive Green. Special finish at a small extra cost.

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STEEL LOCKERS **OFFICE EQUIPMENT** **STORAGE SHELVING** **SHOP EQUIPMENT**

The single tier standard louvre is the most popular general purpose locker

Type S.S. Single Tier

Berger Steel Equipment is manufactured by an organization with more than fifty years' experience in making equipment for the modern school and university. Berger equipment is built to meet the most rigid requirements for durability, utility and structural perfection. All items are quickly available in practically every size and type. Experienced Berger engineers will be sent anywhere without charge to assist architects, builders or purchasing agents in planning new installations.

A double tier standard louvre locker. Send for Catalog No. EL-561

Type S.D. Double Tier

Berger Classroom Wardrobes provide for efficient handling of pupils' clothing. Send for Catalog No. EW-566

Berger Steel Storage and Tool Room Equipment has been designed by engineers qualified by years of experience with storage problems

Steel Shelving can be furnished to fit any storage problem. Send for Catalog No. 509

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Berger benches are available in many combinations. Send for Bulletin No. 525

When many small items must be stored and protected, Berger Flexi-Bilt units offer many advantages not found in any other type of construction. Send for Catalog No. 554

Flexi-Bilt Units

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LYON STEEL EQUIPMENT FOR SCHOOLS

Storage and Wardrobe Cabinets

Single Tier

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LOCKERS

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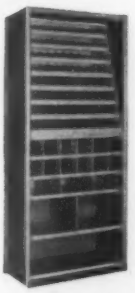

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DURABILT MFG. CO.

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SALES OFFICES IN ALL PRINCIPAL CITIES

SINGLE TIER LOCKERS

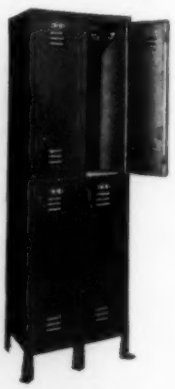
Single Tier

Single Tier lockers provide service in a most convenient form. They are available in the practical heights of 60 or 72 ins. and in various widths and depths.

A Single Tier locker of small dimensions, say 12 ins. wide, 12 ins. deep and 60 ins. high (not including the legs), capably takes care of any ordinary requirements for individual use. The size of the locker, however, should be increased in such cases as school "team" rooms, gymnasiums, etc., in order to make the storing of athletic uniforms, equipment, etc., more convenient. The Single Tier locker is regularly provided with a hat shelf. Because this shelf decreases the space for hanging clothes, authorities generally prefer the 72-in. locker, for the average use, better than the 60-in. locker. Space limitations determine, of course, the size and number of the Single Tier lockers to be installed, but competent planning and careful use of available floor space will reveal the surprising adaptability of this type of locker to orderly and efficient locker rooms.

Standard equipment for Single Tier lockers includes the hat shelf, one double prong ceiling hook and three or more single prong side hooks, depending on size of locker. Equipment can be varied to meet individual requirements.

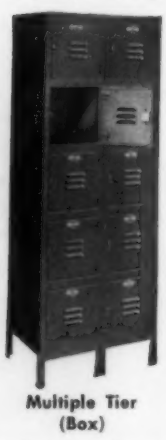
DOUBLE TIER LOCKERS



Double Tier

The Double Tier locker is economical as to space and cost. Necessarily, it is more cramped and provides less storage capacity. This type of locker, however, is ideally suited to conditions where large storage space is not required such as for smaller and younger pupils in grade schools. Double Tier lockers are often used in combination with Single Tier or Multiple Tier lockers to form units that meet the storage problems of almost any unusual condition. In schools, gymnasiums, clubs, etc., Double Tier lockers are often utilized for the storage of gym shoes. In such use, standard equipment is replaced by partitioned shoe compartments, 6 x 6 ins.; the capacity is from 10 to 18 compartments per locker, according to locker size. While 6 x 6 ins. is the accepted size for shoe compartments, other sizes that work out on multiples can be furnished. Single Tier lockers may also be thus utilized.

Standard equipment is the same as for Single Tier lockers, with the hat shelf omitted.



Multiple Tier (Box)

MULTIPLE TIER (BOX) LOCKERS

Multiple Tier (Box), or small compartment lockers as they are sometimes called, have a wide field of usefulness. They can be used to advantage wherever small storage space is required. In schools, gymnasiums, clubs, etc., they are ideal for storing gym suits and shoes, books, lunches, etc. In factories, offices, stores, etc., they are widely used for storing small tools, work shoes, overalls, etc. In combination with Single Tier or Double Tier lockers, they are especially popular.

Like all Durabilt Lockers, they can be furnished for recessing in walls, in single row for arrangement along the walls or in double row or back to back arrangement. They come in tiers three or more high and as many lockers wide as space or requirements permit. No shelves or hooks are furnished with Multiple Tier (Box) lockers.

GYMNASIUM LOCKERS

While in many schools, clubs, lodges, etc., having gymnasiums the average requirements can be taken care of by Double and Multiple Tier lockers arranged according to conditions, the modern trend is toward a combination arrangement shown in the illustration. This type is usually termed "Gymnasium Locker Unit." A complete unit consists of one standard Single Tier locker in combination with double tier lockers, two high, in sections two, three or four wide. Multiple Tier (Box) lockers can be added, of course, to suit individual requirements.

Gymnasium Locker Unit

Standard equipment consists of one hat shelf in large compartments. All compartments have one double prong ceiling hook and three or more single prong side hooks depending on size of locker. Various combinations consisting of Single Tier lockers, Double Tier lockers, two or three high and Multiple Tier lockers can be made up.

GYMNASIUM LOCKER SIZES

(Dimensions are in inches)

Larger Compartments W. D. H.*	Small Compartments
12x12x60	6 x12x30 Double Tier Arrangement
12x15x72	6 x15x36 Double Tier Arrangement
15x15x60	7½x12x30 Double Tier Arrangement
15x15x72	7½x15x36 Double Tier Arrangement
	9 x12x20 Triple Tier Arrangement
	9 x15x24 Triple Tier Arrangement

* Overall height, including legs, is 6 ins. greater.

LOCKER ROOM BENCH TOPS AND PEDESTALS

Quite often, customers want to purchase their locker room benches locally, while others prefer that we furnish them. In order to extend complete service to our customers we are prepared to furnish Bench Tops and Pedestals as follows:

Locker Room Bench (Bench Top and Pedestals)

BENCH TOPS

Yellow pine seems to be the most popular wood for locker benches and, unless otherwise specified, we will always furnish it. Our bench tops are carefully sanded with rounded corners and edges, and finished with one coat of shellac and one coat of varnish. Ordinarily, tops are furnished in 6, 8, 10 or 12 ft. lengths, either 8, 10 or 12 ins. wide and 1½ or 2 ins. thick (Dimensions are nominal.)

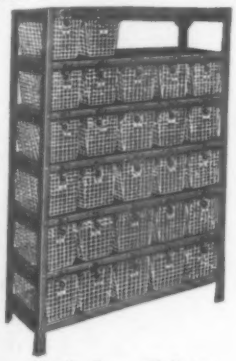
BENCH PEDESTALS

These strong and rigid pedestals are of our special design. They are made with heavy cast iron base and top approximately 7 ins. in diameter, and a strong tubular column 1½ ins. in diameter. There are four holes in the base and four in the top for attaching to floor and bench. Finish is baked-on black japan. Pedestal weighs approximately 7 lbs. Standard overall height is 16½ ins. but other sizes can be furnished. Pedestals should be placed 1 ft. from each end of bench top and not more than 5 ft. apart. When ordering, always give size of benches and quantity of pedestals required.

Pedestal

TYPES OF DURABILT STEEL LOCKERS

BASKET RACKS AND TRUCKS



Single Row, Skeleton Type Rack

Double Row, Solid Ends Truck

The use of steel racks and wire baskets is often preferred to Multiple Tier (Box) lockers. This system is less expensive and gives the advantages of complete ventilation and makes the contents visible for inspection at any time. The security and orderly appearance of the box lockers is, of ourse, sacrificed to some extent. The illustration at the left shows the single row, skeleton type, Basket Rack with baskets in place. This rack has a capacity of 30 baskets and consists of steel shelves with angle uprights, basket separators and padlock hasps which permit locking of the baskets in place. The illustration at the right shows the double row Basket Truck, built with solid ends and casters instead of legs, for portability. Basket Racks can be furnished with legs or without legs, the latter arrangement for the purpose of setting the racks up permanently on cement or terrazzo bases. They can be set up in single row arrangement or built for double row arrangement. Racks may vary to accommodate 30 to 48 baskets each; Trucks, 60 to 84 baskets each.

BASKET RACKS

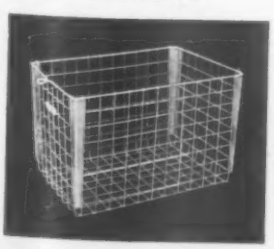
Capacity		W. D. H.
30 baskets 8½x13x8½"	(5 wide x 6 high)	47x13½x61¼"
35 baskets 8½x13x8½"	(5 wide x 7 high)	47x13½x71¼"
40 baskets 8½x13x8½"	(5 wide x 8 high)	47x13½x81¼"
36 baskets 8½x13x8½"	(6 wide x 6 high)	56x13½x61¼"
42 baskets 8½x13x8½"	(6 wide x 7 high)	56x13½x71¼"
48 baskets 8½x13x8½"	(6 wide x 8 high)	56x13½x81¼"
30 baskets 11½x13x8½"	(5 wide x 6 high)	62x13½x61¼"
35 baskets 11½x13x8½"	(5 wide x 7 high)	62x13½x71¼"
40 baskets 11½x13x8½"	(5 wide x 8 high)	62x13½x81¼"

Heights listed above do not include 4¾-in. legs.

BASKET TRUCKS

Capacity	W. D. H. Overall
60 baskets 8½x13x8½" ..... 5 wide x 6 high Double Row.	47x27x65"
84 baskets 8½x13x8½" ..... 6 wide x 7 high Double Row.	56x27x75"
60 baskets 11½x13x8½" ..... 5 wide x 6 high Double Row.	62x27x65"
84 baskets 11½x13x8½" ..... 6 wide x 7 high Double Row.	74x27x75"

WIRE BASKETS



Because of the rough treatment wire baskets receive, we recommend the exceptionally strong basket illustrated, for use in Durabilt Basket Racks and Trucks. It is made of 1 in. square mesh No. 16 gauge wire, with 3/16-in. top frame and formed steel angle reinforcements at corners. To prevent rust, baskets are finished with a heavy coating of tin after manufacture. Pinched padlock loop in top frame holds basket in line with front of shelf when padlock is attached. A brass, satin nickel finished number plate is riveted on one end approximately 2 ins. from top edge.

Standard sizes are: 8½ ins. wide x 13 ins. deep x 8½ ins. high; 11½ ins. wide x 13½ ins. deep x 8½ ins. high. Can be furnished in ¾ and 1 in. mesh.

Two-in-One

TWO-IN-ONE LOCKERS

W. D. H.*	W. D. H.*
15x12x60"	15x15x72"
15x15x60"	15x18x72"
15x18x60"	15x21x72"
15x12x72"	

Equipment consists of two hat shelves, vertical partition dividing lower part into two coat compartments each having one double prong ceiling and two or more single prong side hooks, depending on size of locker. Can be furnished without partition when desired.

* Overall height, including legs, is 6 ins. greater.

TWO PERSON LOCKERS

W. D. H.*
15x15x72" without coat rod
15x18x72" with coat rod
15x21x72" with coat rod

Coat compartments are 7½ ins. wide by 54 ins. high. Hat compartments are 15 ins. wide by 9 ins. high, making total height of section 72 ins. **exclusive of legs.**

EQUIPMENT—One double prong ceiling hook and two or more single prong side hooks, depending on size of locker. Lockers 18 ins. deep and over have a coat rod in addition to hook equipment.

Two Person

DUPLEX LOCKERS

W. D. H.*
15x15x72"
15x18x72"
15x21x72"

Two lockers in special 15-in. wide frame. Each locker 7½ ins. wide. Provides 2835-cu. in. capacity in 18-in. deep locker.

EQUIPMENT—One hat shelf spaced 21 ins. down from top, one single prong coat hook above shelf; one double prong ceiling hook bolted to shelf and two or more single prong hooks below shelf. Coat rods can also be furnished. Requires only two locks. Very economical and conserves floor space.

SCHOOLS AND GYMNASIUMS

For clothing storage, the Durabilt Lockers best suited to schools and gymnasiums are the specially equipped full length or Single Tier lockers either recessed in the walls, on concrete bases, or free standing on legs. Where Single Tier lockers are not desired, we recommend the use of Double Tier Lockers. Multiple Tier Lockers, or "Box" Lockers are ideally adapted to storage of gym suits, books, sewing materials, etc. Combinations of any of these types, are of course, available. Durabilt Basket Racks and Trucks for gymnasiums, pools, etc., furnish well, ventilated and secure storage facilities.

Duplex

FRED MEDART MANUFACTURING CO.

Potomac and Decalb Streets

Saint Louis, Mo.

ENGINEERING AND SALES SERVICE IN ALL PRINCIPAL CITIES

MEDART STEEL LOCKERS

LOCKER CONSTRUCTION

Design—Built on "unit principle" each locker having its individual door, frame, top, bottom, etc., all parts interchangeable.

Doors—Made of 16-gauge steel, reinforced by flanging top and bottom edges, and channelling side edges.

Frames—Made of 16-gauge steel, formed into channel shape with rolled inner edge. Upright and cross members electrically welded together, making a true, square and rigid frame.

Body of Locker—The backs, sides, tops and bottoms are made of 24-gauge steel.

Locking Device—Three-point rubber-cushioned contact in single-tier lockers; two-point contact in double-tier lockers. Doors are pre-locking self-latching type.

Group Locking Device—Can be furnished if required. (Entire battery of lockers locked by one master lock.)

Door Handle—Lift type with concealed padlock eye.

Locks—As selected from Catalog.

Hinges—36- and 42-in. doors hung on two hinges; 60-in. doors on three hinges; 72-in. doors on four hinges. Hinges electrically spot-welded to frame and bolted to side flange of door with two bolts. Bolts equipped with lock washers.

Legs—Adjustable front legs to overcome floor irregularities. According to width of lockers and grouping, legs are spaced 30 to 36 in. apart with a clearance of 4⅞ in. above floor.

Cabinet Base—An extra 4⅞-in. cabinet base can be furnished at an additional charge.

Ventilation—All standard locker doors are louvred at top and bottom to provide ventilation—three louvres top and bottom for 36- and 42-in. lockers, six louvres top and bottom for 60-in. lockers and nine for 72-in. lockers. Box lockers, three louvres. (Round hole perforations can be substituted for louvres at no additional cost.)

Standard Finish—School Furniture Brown, or Olive Green. All parts are thoroughly cleaned before enameling; enamel is baked on to hard finish. Special colors to harmonize with walls or interior trim may be had at an additional charge.

Hooks—Made of malleable iron, cadmium plated. Lockers 12 and 15 in. deep have three single-prong wall hooks and one double-prong ceiling hook; lockers 18 in. or more in depth have five single-prong wall hooks.

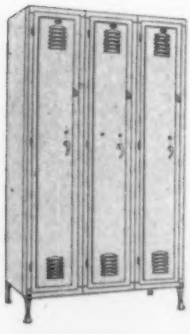
Coat Rods—Standard equipment on all lockers 18 in. or more in depth and on all two-person lockers.

Shelves—Single-tier lockers have shelves extending the full depth and width of lockers. Shelves have rolled front edge and are bolted to sides. Double-tier lockers do not have shelves. Extra shelves can be provided.

Tops—All lockers have individual flat tops. Sloping tops can be furnished at extra cost.

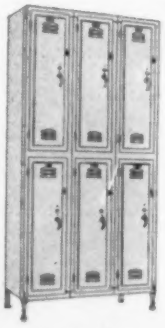
Numbering—All lockers are furnished with aluminum number plates to be bolted in place. Unless otherwise specified lockers are numbered consecutively from "one" up.

LOCKER SIZES



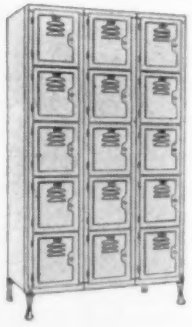
Single Tier Lockers

Wdth.	Dpth.	Hght.
12″	12″	60″
12″	15″	60″
12″	18″	60″
15″	15″	60″
15″	18″	60″
12″	15″	72″
12″	18″	72″
15″	15″	72″
15″	18″	72″
18″	18″	72″
18″	21″	72″



Double Tier Lockers

Wdth.	Dpth.	Hght.
12″	12″	30″
12″	12″	36″
12″	15″	36″
12″	18″	36″
15″	15″	36″
12″	12″	42″
12″	15″	42″
15″	15″	42″



Box Lockers

Wdth.	Dpth.	Hght.	Tiers
12″	12″	12″	5
12″	12″	12″	6
12″	15″	12″	5
12″	15″	12″	6
15″	15″	12″	5
15″	15″	15″	4
18″	18″	12″	5
18″	18″	12″	6

Also Gym Suit Lockers and Two-Person Lockers

To quote prices we must have the following information: Number of lockers of each size, number that are single row (wall type), number that are double row (back to back), number to be recessed and amount of trim required, color, catalog number of locks desired, and point of delivery.

SHELVING FOR WIRE BASKETS

Illustration shows a section of wire basket shelving seven baskets high (6 ft. 0 in.) with basket dividers and padlocking arrangement for self-service. Shelving sections nine baskets high (7 ft. 6½ in.) for use in attendants' rooms can also be furnished.

A section for either 13 x 9 x 8-in. or 13 x 12 x 8-in. baskets is 40 in. long and 13¾ in. deep, accommodating four small or three large baskets to each shelf. This shelving is of rigid open construction, providing maximum ventilation for baskets. Dividers as shown in illustration are standard equipment. An aluminum number plate for each basket space is provided. Finished in School Furniture Brown, or Olive Green Enamel.

Also: Trucks for Wire Baskets—made up of two standard steel shelving sections bolted back-to-back, cross-braced for rigidity, and with anti-friction steel rollers.

WIRE BASKETS

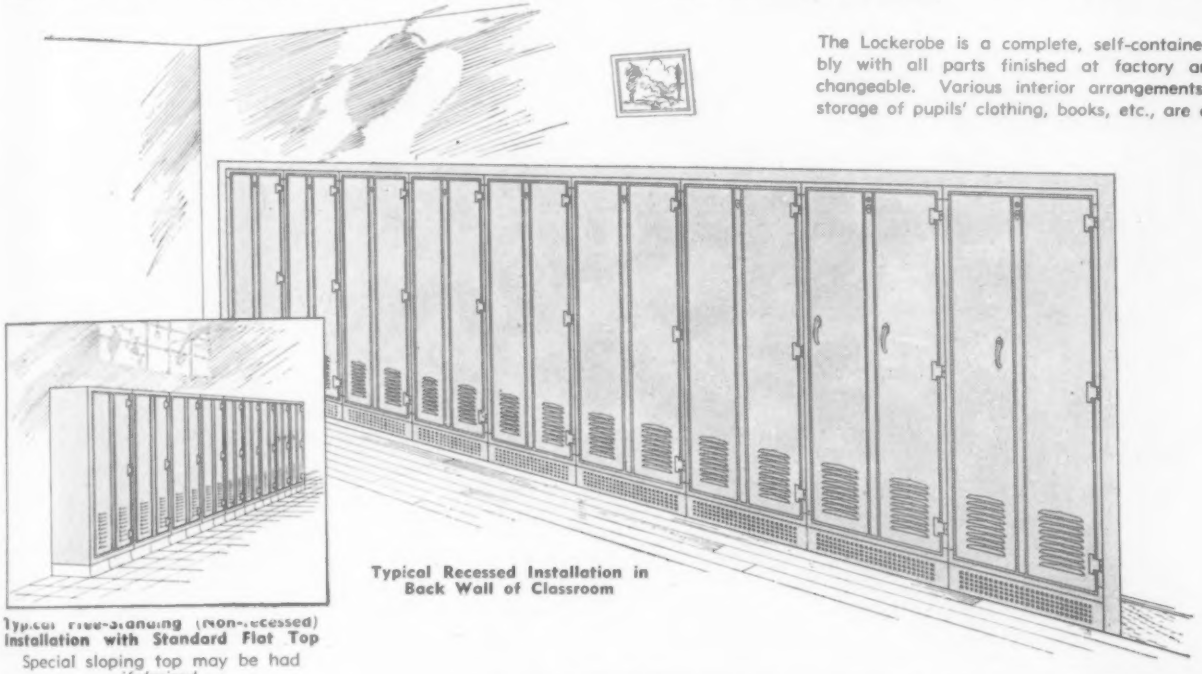
Body of 15-ga. wire, with 6-ga. top frame and 13-ga. corners. "X" braced bottom; aluminum number plate. Two sizes in both standard 1″ and special ¾″ mesh: 13 x 9 x 8″ and 13 x 12 x 8″.

MEDART LOCKEROBES

A Lockerobe classroom assembly consists of a multiple of pupil units, each of which is enclosed by one pair of simultaneously controlled doors. All doors are opened and closed by one person (the teacher or monitor) simultaneously, thus eliminating any need for children of elementary school age to operate the doors of the individual units. School officials approve this feature which eliminates possibility of injury, noise and confusion in the classroom and needless delay, in bringing the class to order, or upon dismissal. A simple door operating mechanism eliminates future maintenance problems.

Constructed entirely of steel, the Lockerobe is sanitary, fire-resisting, termite-proof, and easy to keep clean. When recessed, Lockerobes require a recess depth of only 16 in. This dimension when contrasted to depth required by conventional type wardrobes represents an unusual opportunity to reduce classroom cubage and cut building costs. Lockerobes also serve as an important adjunct to room ventilation systems. Air can be withdrawn through grille base and after passing between back of units and recess wall, can be expelled through conventional exhaust pan or duct.

The Lockerobe is a complete, self-contained assembly with all parts finished at factory and interchangeable. Various interior arrangements for the storage of pupils' clothing, books, etc., are available.



Typical Recessed Installation in Back Wall of Classroom

Typical Free-Standing (Non-recessed) Installation with Standard Flat Top

Special sloping top may be had if desired

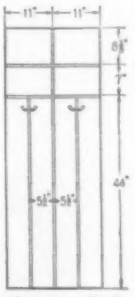
Lockerobe Auxiliary Units

Bookcases, Teachers' Wardrobes and Combination Bookcases and Wardrobes furnished in 22-in. widths. To determine over-all length of classroom assembly and of recess required, where one or more auxiliary units are required, add the actual width of auxiliary units to the above pupil unit and recess dimensions.

Number of 22-in. Pupil Units required	Over-all length of assembly	Length of recess required
2	3 ft. 8 in.	3 ft. 11 in.
3	5 ft. 6 in.	5 ft. 9 in
4	7 ft. 4 in.	7 ft. 7 in.
5	9 ft. 2 in.	9 ft. 5 in.
6	11 ft. 0 in.	11 ft. 3 in.
7	12 ft. 10 in.	13 ft. 1 in.
8	14 ft. 8 in.	14 ft. 11 in.
9	16 ft. 6 in.	16 ft. 9 in.
10	18 ft. 4 in.	18 ft. 7 in.

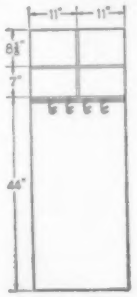
Each 22-in. pupil unit will accommodate 4, 5, or 6 pupils, depending on the interior arrangement selected. (See below.)

Interior Arrangements



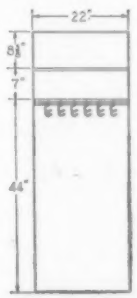
Interior "A"

Each unit accommodates 4 pupils. Provides 4 individual hat compartments and 4 individually partitioned coat compartments.



Interior "C"

Each unit accommodates 4 pupils. Provides 4 individual hat compartments, coat rod and 4 sliding double-prong coat hooks.



Interior "D"

Each unit accommodates 6 pupils. Provides 2 full width shelves, coat rod, and 6 sliding double-prong coat hooks.

MEDART ENGINEERING SERVICE

A competent staff of Medart engineers is available to help you plan and lay out the most efficient and economical installation of equipment to meet your own special requirements. No obligation.

MEDART CATALOGS

Steel Lockers .....Catalog L-7
Lockerobes ....Catalog LRM-4
Telescopic Gym Seats Catalog GS-3
Basketball Backstops Catalog BB-2
Physical Fitness (Gymnasium) Equipment .....Catalog G-4

Also see pages 366 and 367, this issue

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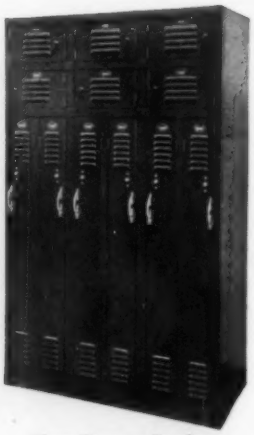
STEEL LOCKERS -- STORAGE and WARDROBE CABINETS
STEEL SHELVING -- TOOL UNITS -- METAL SPECIALTIES

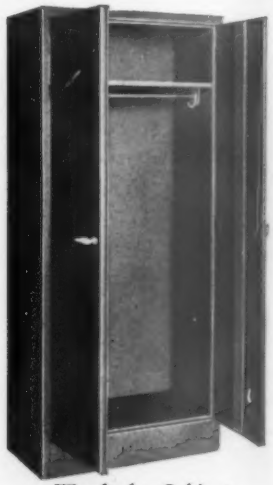
Single Tier Locker
Type 50-U-2

Box Lockers
Type 40

Eight-Compartment Locker
Type 82



Two-Person Lockers
Type 734



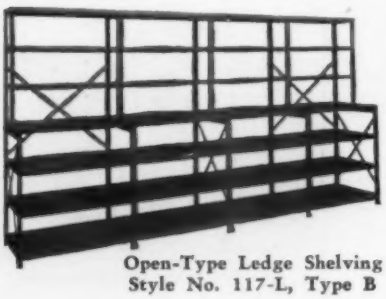
Wardrobe Cabinet
Type 3618-W

STEEL LOCKERS

Penco single tier, double tier, box and multiple lockers of various types provide the complete storage facilities needed by all schools. Catalog No. 46 contains specifications, construction details and space-saving suggestions. Write for your copy.

STEEL CABINETS

Manufactured in many styles and sizes for wardrobe, storage or combination use.



Open-Type Ledge Shelving
Style No. 117-L, Type B

Closed-Type Plain Shelving
Style No. 118, Type A

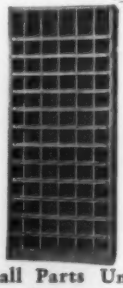
Closed-Type Ledge Shelving
Style No. 119-L, Type A

STEEL SHELVING

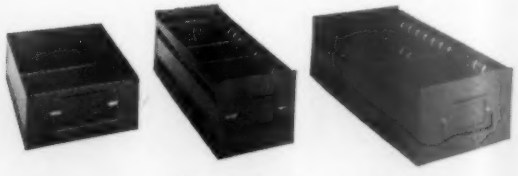
There are six basic types of Penco Steel Shelving which, with readily added accessories, provide protection and security for any commodity that requires storage. Catalog No. 45 contains detailed specifications and construction details. Write for your copy.

Steel Table No. 651

Steel Counter No. 652



Small Parts Unit
No. 154



Special Steel Boxes

Many prominent schools, clubs and industrial plants have been equipped with **Penco Standard Products** which are specified by architects for their durability and high standard of workmanship. They are known throughout the trade as the best that money can buy.

Write for the complete Penco Catalogs. Keep them in your post-war planning file.

DUDLEY LOCK CORPORATION

Chicago 6, Illinois

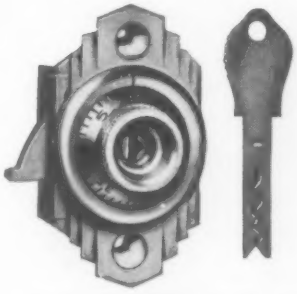
AS THE PIONEER in the use of combination padlocks for schools, Dudley has developed a type of locking equipment that has resulted in a simplified easy control, trouble-free locker system operation. Dudley locks are used by the majority of schools because they give extra service, extra protection and extra value.

SPECIFY DUDLEY

Dudley masterkeyed locks are made with exclusive Bell-type pin tumbler, pick-resistant cylinder. The famous Bell Key affords greater protection against duplication because it is not made on the commercial key making machine.

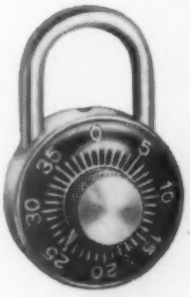
RD-2 ROTODIAL. A strong durable lock for lockers, scientifically tested, eliminates pilferage, is fool-proof, locks automatically disarranging all tumblers and dial.

★



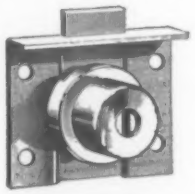
S-540. Masterkeyed combination lock for lockers with automatic latch release. Locks automatically disarranging tumblers and dial. Combination instantly changed with special reset key without removing any part of lock from locker.

P-570. Self-locking. Tumblers and dial disarranged on opening and dial moved to a new position. Masterkeyed alone or in the same series as other Dudley masterkeyed locks.

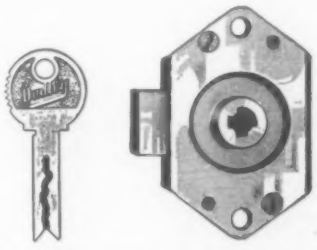


B-2-B ROTOPOINT. A sturdily constructed lock for lockers. Locks when shackle is pushed into the lock case and knob turned.

★



W-510. Key lock for wood drawers and cabinets 7/8" and 1 1/8" thickness. Keyed different or alike. Masterkeyed alone or in same series with other Dudley masterkeyed locks.



S-530. Key lock for lockers and steel cabinets. Keyed different or alike. Masterkeyed alone or in same series with other Dudley masterkeyed locks.

AL-4. Masterkeyed combination lock for lockers with automatic latch release. Combination readily changed.

Different types of masterkeyed locks—S-540, P-570, S-530, W-510—used on different kinds of equipment in the same department can be furnished under the same master, if desired, simplifying supervision and control.

Dudley Keyless Lock

Dudley representatives are lock specialists experienced in the school lock field. They are competent to make a survey of the locking requirements and to recommend a system that will meet your needs. **Write us today!**

NATIONAL LOCK COMPANY

Rockford, Illinois

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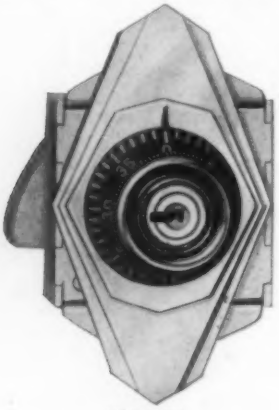
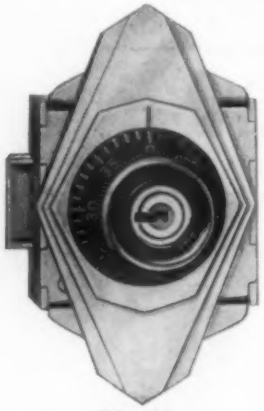
ROCKFORD COMBINATION LOCKER LOCKS are made for standard Steel, Wood or Masonite Lockers of any style or make. It is the complete line assuring the utmost in security, convenience, simplicity and durability. Rockford Locks have proven their worth in hundreds of Educational Institutions. For simplified and complete supervision and control select the Rockford Line.



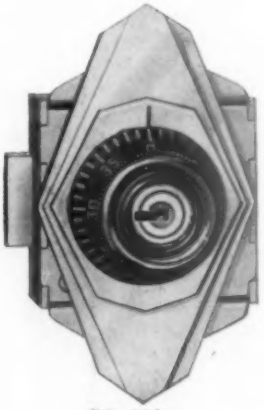
NO. 267

Master Keyed Combination Self Locking, for use on Lockers having spring latch bar. Over 64,000 different combinations available. No bolt or rivet heads visible from outside. Can also be furnished without Master Key feature.



NO. 269

For use on Box type Lockers having no latch bar. Lock has beveled spring bolt. Closing door locks lock and spins dial concealing last figure of combination. Furnished with or without Master Key feature.



NO. 271

Master Keyed Combination Dead Bolt Lock having square end dead bolt. Lock does not have self-locking feature. Combinations of this lock and Nos. 267 and 269 can easily be changed by removing escutcheon plate and turning dial.

COMBINATION SHACKLE LOCKS

Keyless Combination Self-locking Shackle Lock that is fool proof, secure and durable. Inserting shackle upsets combination by turning dial. Must be completely re-dialed to open. Over 64,000 different combinations available. This is a very popular lock in the Rockford Line. Lock case is Chromium Plated and dial is black with white figures.

Master Keyed for ease and convenience of supervision. Can be Master Keyed with all built-in Locks shown above, or Laboratory Lock shown below. Students operate lock by combinations, while officials gain access by use of Master Key. Dial is locked against rotation when shackle is open.

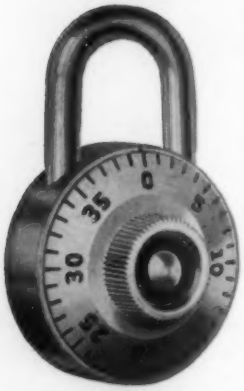
NO. 265

NO. 264

NO. 275

COMBINATION SHACKLE LOCK

Where Locks are purchased by School authorities to be sold on a no-refund basis, this Lock is suggested. The finish is Baked Aluminum and Varnish, a very attractive item, and all mechanical parts of any importance are made of Brass. Parts requiring extra strength are made of Steel, Cadmium Plated and are completely rust-proof. The shackle is self-locking and there are over 64,000 combinations available. Dialing is ratchet or click type permitting rapid operation and the large numerals are easily read, even in dark corridors or locker rooms. This is a full-size Lock of special value and should be re-sold to the students at 10¢ to 25¢ more than the actual School cost.

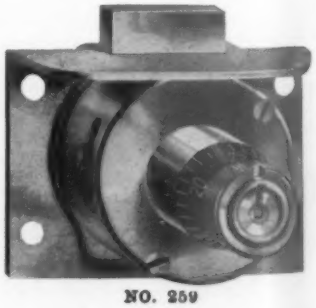


NO. 275

NO. 259

COMBINATION DRAWER LOCK

Combination Master Keyed Laboratory Drawer or Door Lock. Combination can quickly be changed without removing lock from mortise. Lock is of Solid Brass construction and is not affected by ordinary Laboratory fumes and acids. Lock is reversible for use on right or left hand doors.



NO. 259

[Illustrated here are only a few of the many School Locks available in the Rockford Line. Ask for illustrated folder showing complete line.]

THE YALE & TOWNE MFG. CO.

TRADE YALE MARK Stamford, Conn. TRADE YALE MARK

INTRODUCE **true economies, maximum security and increased efficiency in locker rooms with these Yale Combination Locker Locks. They supply a degree of protection heretofore unavailable in locks of this type for locker use; security which discourages temptation, aiding in character development. Large easily read dials simplify operation, and minimize congestion and delay in locker rooms.**

FOR ALL MAKES AND ALL TYPES OF STEEL LOCKERS

FOR NEW LOCKERS AND FOR REPLACEMENT OF WORN OUT LOCKS ON OLD EQUIPMENT

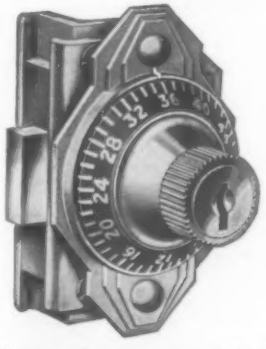
Exclusive Yale Features:

Maximum Security: Combinations dialed on three positive numbers. Combination must be known and cannot be located by manipulating dial.

Combination Disperser automatically upsets combination as lock is locked. A double safeguard. Acts as a defense against tampering.

Combination Changeable with every change of locker occupant—without removing lock from door. Feature secluded in back of lock in same secure manner as in Yale Bank Locks.

Supervisory Control of a group of lockers or the collective groups of a city school system obtained by the **Yale Emergency Key Control.** The key used is assigned exclusively to these locks.



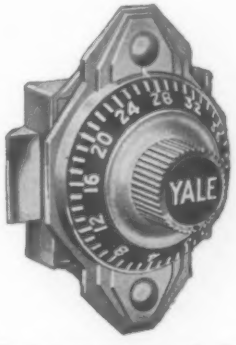
For Lockers with Automatic Bolt Release Mechanism. Automatic Self-Locking Vertical Sliding Bolt. A New Locking Principle.

Emergency Key Controlled

No. L3374-CM, Cadmium finish
No. L3374-DZ, Chromium finish

Dial Operated Only

No. L3364-CM, Cadmium finish
No. L3364-DZ, Chromium finish



For Steel Compartment and Box Type Lockers. Beveled Spring-bolt, Automatic Self-Locking.

Dial Operated Only

No. L3369-CM, Cadmium finish
No. L3369-DZ, Chromium finish

Emergency Key Controlled

No. L3379-CM, Cadmium finish
No. L3379-DZ, Chromium finish

For Lockers with Gravity Type Locking Device. Dead Bolt Manually Operated.

Dial Operated Only

No. L3368-CM, Cadmium finish
No. L3368-DZ, Chromium finish

Emergency Key Controlled

No. L3378-CM, Cadmium finish
No. L3378-DZ, Chromium finish

NEW YALE COMBINATION PADLOCKS

FOR BASKET LOCKERS AND ALL OTHER TYPES AND MAKES OF STEEL LOCKERS

The finest and most secure combination padlocks yet produced

No. 589 Master-Key Controlled Dial

Same features of maximum security and automatic combination disperser as the above built-in type.

No. 579 Lock, Dial operation only.

No. 589 Lock, Dial operation with emergency key, provides supervisory control of lockers. May also be used with any of above built-in types under same control key.

These padlocks have ¼" diameter steel shackles and the graduations and numerals on the black enameled dial are easily read.

No. 515 Lock, Dial operation only. A good secure medium priced padlock. The steel shackle is $\frac{9}{32}$" in diameter and the case of solid rustless metal is attractively finished in bright baked aluminum.

The Yale Rotating Dial provides fast accurate dialing.

The Combinations are unlimited on all above padlocks.

No. 515 Dial Operated Only

C-O-TWO FIRE EQUIPMENT COMPANY

Newark 1, New Jersey

SALES AND SERVICE IN ALL PRINCIPAL CITIES AND IN CANADA

Carbon Dioxide Fire Extinguishing Equipment

IT'S SAFER because IT'S FASTER

C-O-TWO carbon dioxide fire equipment is particularly adaptable for the protection of cafeterias, domestic science kitchens, manual training, woodworking, electrical, machine shops, laboratories and wherever flammable liquids are used or stored. C-O-TWO gas kills fire in seconds without damage to materials or equipment.

C-O-TWO KILLS FIRE — SAVES LIFE!

WHAT IS C-O-TWO?—Carbon Dioxide is a clean, pure, dry, odorless and non-damaging inert gas. It is the fastest and most efficient of modern fire extinguishing agents.

C-O-TWO Extinguishers smother fire instantly under a heavy, dense, blanket of Carbon Dioxide Gas. One of Carbon Dioxide's most valuable properties is its high ratio of expansion (450 to 1). When liberated, the gas is discharged under its own pressure without pumping and by the force of its own expansion it penetrates every nook and corner, even seeking out cracks and crevices where fire might lurk. It reaches all out-of-the-way places which cannot be reached by other extinguishing agents. It is equally effective when used indoors or outdoors, and is not affected by temperature and does not deteriorate.

Carbon Dioxide will not damage or injure machinery, equipment, woodwork, finishes, fabrics or materials with which it may come in contact. It is a non-conductor of electricity, which is an added safety feature to fire fighting.

The design of C-O-TWO equipment eliminates any possibility of freezing in cylinders, valves, discharge hose, horn, nozzles or piping.

Carbon Dioxide has many commercial uses, and C-O-TWO refills are obtained quickly and conveniently from direct factory branches and recharging plants located in practically every large city and seaport throughout the world.

WHO IS C-O-TWO?—"C-O-TWO" is the registered trade mark and corporate name of this company. Specializing for many years in the development of carbon dioxide fire extinguishing equipment, this company has committed itself to a policy of maintaining a position of superiority in quality, workmanship, design and operation which merits careful consideration in the selection of your fire extinguishing equipment.

The high standard of C-O-TWO equipment is further assured by the rigid tests and unqualified approval of the Underwriters' Laboratories, Factory Mutual Laboratories and all Federal Bureau.

To be safe, specify "C-O-TWO" and this company's name when ordering

WHEELED TYPE
50 to 100 lbs.
(Net Gas Contents)

MANUAL AND AUTOMATIC SYSTEMS

C-O-TWO PORTABLE EXTINGUISHER

The new and improved C-O-TWO "Squeeze-Grip" type of valve for hand portable extinguishers is another of C-O-TWO's contributions to fire protection.

The C-O-TWO "Squeez-Grip" valve has a "pressure-closing seat," which is closed against leakage by the tremendous pressure of carbon dioxide within its own cylinder.

Opening and closing of a "hand-wheel" type portable is a slow operation when compared to a "Squeez-Grip" type. First the portable is set down and the hand-wheel is turned to the open position which discharges carbon dioxide before the portable is picked up. It is also necessary to set the portable down to close the valve.

There is no need to set a "Squeez-Grip" portable down as the valve is easily opened or closed while carrying the extinguisher. The valve is opened just as fast as you can close your hand as there is nothing to do but squeeze the release lever over the carrying handle.

The "Squeez-Grip" type extinguisher is more efficient than a hand-wheel type as there is no "loss of gas" or "time" while maneuvering around a fire.

Wheeled portables are furnished with seat and disc type valves.

All C-O-TWO valves are fitted with recoil preventors and have a separate side safety or pressure relief disc.

PORTABLE
SQUEEZ-GRIP
4 to 15 lbs.

So simple a woman can operate it. It is as easily operated as closing your fingers

C-O-TWO FIRE EXTINGUISHING SYSTEMS

The C-O-TWO system consists of one or more steel cylinders filled with liquid carbon dioxide under pressure; a discharge head attached to each cylinder for quickly releasing the contents and a simple piping system terminating with specially designed C-O-TWO discharge nozzles in the protected space.

Several types of manual or automatic releases are available for actuation of C-O-TWO systems. All C-O-TWO systems are arranged for manual operation by local manual control or by remote manual control.

Two or more spaces can be protected with a single system by flooding all spaces simultaneously, or a number of spaces may be protected with one group of cylinders, by use of C-O-TWO direction or selector valves, for direction of gas into the proper space.

FIXED HOSE REEL TYPE

TRADE C-O-TWO MARK

Courtesy White Motor Co.

SCHOOL TRANSPORTATION

A growing number of pupils are being transported to central schools, as it is increasingly recognized that the small school of yesterday cannot offer the educational opportunities of the larger school. Transportation will become, therefore, of larger importance in many school systems and will require much more attention than has heretofore been devoted to it. At this time it offers a particularly acute problem because of the limited number of new buses available for purchase and the shortage of repair parts. Every emphasis must be placed upon maintaining present equipment in operation. Because of the extreme importance of effective operation, our School Transportation Section this year is devoted primarily to this phase of the problem.

Courtesy of Penn Yan Bodies

PURCHASE, CARE, AND USE OF SCHOOL BUSES

By A. R. MEADOWS

Acting Director, Division of Administration and Finance, Alabama State Department of Education, Montgomery, Ala.

PRIOR to the war, school transportation in America developed piecemeal from single vehicle operation scattered here and there over rural areas throughout the country to fleets estimated at 94,000 buses for the nation, or almost twice the number of all other passenger buses. In starting school transportation, local schools and school administrative units contracted with private enterprise—usually a citizen in the community who was able to purchase a bus—to provide school bus service. Purchase procedures, care, and use of buses were left to the individual owner. The contract covered the school bus route, the number of children to be transported, the approximate school bus schedule, and the length of school term. There were no standards of construction, care, or use of buses. Traffic flow was light and rural conditions did not permit high speed. Driving regulations were simple, largely involving keeping the bus in the middle of the narrow roads of that time.

Immediately following the advent of mass production in the automotive industry, which was accompanied by a great expansion in highway construction, practically every condition relating to school transportation began to change. The number of buses and the number of pupils transported were greatly enlarged. The number of total motor vehicles and the speed of general motor traffic increased. As school boards began to operate larger numbers of buses, some consideration was given to the purchase, care, and use of buses.

Research Studies Favor Public Ownership

School boards throughout America are giving more and more consideration to public ownership of buses versus private ownership. A number of searching research studies have been made on the advantages and disadvantages of public and private ownership of buses. The overwhelming conclusions of such research studies have been in favor of public ownership because of the administrative advantage in routing, purchasing, using, and caring for school buses. Part of the problem of routing a school bus rests on the location of a driver or owner-operator near or at the otherwise logical beginning of the passenger route. There are more potential bus drivers than potential owner-operators, due to the fact that the latter require capital investment. School boards have found it possible to operate publicly owned buses more economically than privately owned buses. Boards of education, operating without the profit anticipated by private enterprise, can purchase bus equipment and operating supplies at fleet prices and are usually exempt from certain federal and state excise taxes.

Purchasing on a Business Basis Reduces Costs

Perhaps one of the most significant emerging contributions to the school transportation phase of public education is that of improved purchasing procedures. The State of North Carolina purchases all buses on state bids for the entire state and, prior, to the war, purchased buses at about 50 per cent of the retail cost. A number of other states, for example—Alabama, have been able to secure prices comparable to those of North Carolina through individual county purchases, pooled county purchases, and through state bids requested by county boards of education.

Under these purchase procedures, bid invitations are submitted for school bus chassis, without the body, to

be delivered to body manufacturing companies in accordance with chassis specifications developed by the state and used either by the state or by local districts. Bids are submitted to body manufacturing companies for the body to be mounted on the chassis delivered to the body manufacturing company, according to specifications. The successful body bidder agrees to transport local drivers provided by the purchaser to the body manufacturing company and to assist in convoying the buses to their local destinations. The body manufacturing company is required to cover the buses in convoy for actual property damage insurance to safeguard the school boards on the buses in transit. The State of Mississippi is practicing a policy of asking body and chassis manufacturing companies to submit prices to the state board of education on chassis and body separately for purchase by local school boards. The state board of education approves chassis and bodies separately meeting specifications and approves prices that appear to be reasonable and satisfactory.

The following suggestions are offered in the purchase of school bus equipment and operating supplies:

1. Bid invitations should be submitted to body and chassis manufacturing companies rather than to local dealers. Copies of bid invitations may well be sent to local dealers.

2. Body and chassis should be purchased on specifications approved by the state board or state department of education.

3. Chassis should be purchased separately from the body. There has been a tendency for the chassis dealer, in dealing directly with local boards of education, to demand and insist upon a profit on the bus body to be mounted on the chassis, even though the local dealer has no business connection with the sale of the school bus body. The purchase of the chassis and body separately should help to eliminate this type of profiteering racket.

4. The state should provide a financial plan for spreading the payment for school buses, when bought in fleets, so that the annual cost of new buses will not be an undue burden on the annual budget when cash funds are not available for such purchase. The schedule of payment for new buses should not be extended beyond the anticipated life of the equipment. The purchase of new buses is a capital outlay expenditure corresponding to capital outlay expenditures for school building facilities, except that the life of a school bus is much shorter than that of the school building. The same financial plans for capital outlay expenditures on school buildings may be adapted to the purchase of new school buses. Funds for capital outlay expenditures for school buildings are provided through the sale of school bonds or on a pay-as-you-go basis. The purchase of school buses may be financed in the same manner. The pay-as-you-go plan has the advantage of eliminating interest costs. However, school bonds for the purchase of buses are usually scheduled for retirement over a period of from six to eight years and have been sold at par and interest rates as low as 1¼ per cent annually. In North Carolina, a state fund is provided by the state legislature for the purchase of school buses on a cash basis. In Alabama, school boards may issue and sell capital outlay bonds for the purchase of school buses or buy on a cash basis. In Mississippi, school boards may borrow funds locally for the purchase of school buses and schedule the retirement of the loans over a period of three years or may purchase buses from cash on hand where available. In the transfer from private ownership to public ownership of school buses, it is difficult, and usually impossible, for a school board to finance the purchase of a fleet of buses without issuing

Courtesy of Superior Coach Corporation

Buses being convoyed from factory to school. The body manufacturing company pays property insurance covering buses in transit

school bonds or securing loans to be retired over a period extending beyond one year.

5. The manufacturing companies offering school bus equipment for sale should be required to give a reasonable guarantee as to the performance of the equipment.

6. The standards adopted by the 1939 National Conference on Uniform Standards for School Bus Construction should serve as minimum standards in the development of state and local specifications on school buses.

7. Where school boards operate under the private contract system, private operators should be required to meet state specifications in the procurement of school buses.

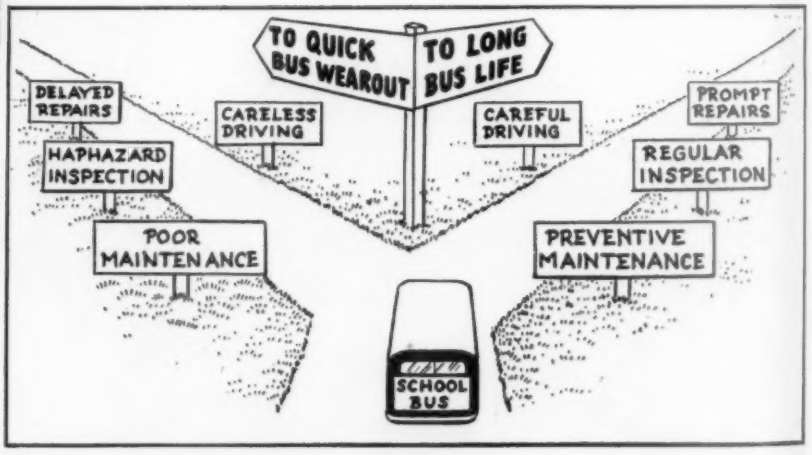
8. School boards owning and operating their own school buses should purchase fuel and lubricants through bid procedures and specifications in quantities so as to take advantage of quantity sales prices.

9. School officials, as representatives of the people on educational matters, should sponsor broad legislation, where not already provided, to permit the organization and administration of school transportation on a sound business basis to meet educational needs within the state. Due to changing conditions in construction and design of school buses, statutes should delegate the details of administration and organization to the state board of education or the chief state school officer and his staff.

10. The number of buses to be purchased and the sizes thereof should be determined through surveys of area involved, the educational program, and the number of children to be served.

11. It will be difficult, if not impossible, to administer school transportation on a business basis in many parts of the United States until thousands of existing small rural school administrative units are reorganized into larger administrative units comparable to the size of a county or larger, at least for school transportation purposes. Small school administrative units find it difficult indeed to route school buses so as to avoid unnecessary duplication of bus use and mileage.

Left—In the war community of Vallejo, California, buses loaned by the Navy supplement the regular equipment of the school district. This relieves the bus shortage somewhat but does not lessen the need for preventive maintenance



Right—Proper training of drivers and constant supervision to assure carrying out of instructions mean the difference between long bus life and quick wearout

From School Transportation in Wartime, courtesy of American Automobile Association

Reserve Buses for School Use

The use of school buses is now regulated by the Office of Defense Transportation war emergency regu-

lations. In normal times, school buses were used for various purposes including the transportation of produce, cattle, fertilizer, and other commodities, in addition to passengers. In general, school buses as such should be reserved for transportation of pupils and school employees for school purposes.

Eliminate Roadside Repairs

The provision of school transportation and the routing and scheduling of school buses are educational matters but the care of school buses is a technical matter and qualified technicians should be employed to maintain school buses. The shortage of school transportation equipment, gasoline, and manpower has emphasized the great need for preventive maintenance in school transportation. Public education has a direct responsibility for educating and training the public in preventive maintenance of motor vehicle equipment. One of the chief jobs is to institute an efficient and economical system of preventive maintenance for school buses. In general, the American public has trained automotive mechanics to make emergency repairs on motor vehicles rather than to maintain them so as to eliminate the need for emergency repairs. This has been the simple result of the motor vehicle operator's waiting until he needs emergency repairs to take his vehicle to the mechanic.

In the prewar days of abundant supplies of vehicles and vehicle parts, the general trend throughout America was to trade in the vehicle, when it was anticipated that it would soon need repairing, for a new vehicle and to pay little attention to parts because they could be replaced at reasonably low cost. We are now painfully learning to revise these practices and need great concentration on proper maintenance of the entire motor vehicle to prevent the need for replacement, even of parts, as long as possible. A few large fleet operators found it safer and more economical, even prior to the war, to institute rigid programs of preventive maintenance rather than wait for emergency repairs or for replacements. School buses, in general, operate relatively low mileage annually and over the life of the school bus. Preventive maintenance is even of greater importance to the safe and economic operation of the school bus. Preventive maintenance programs should be designed and operated to eliminate emergency roadside repairs.

A number of states are now instituting driver training and mechanic training programs through the use of federal vocational funds for the purpose of training personnel to properly drive and care for the school buses. Some excellent results are now being obtained in preventive maintenance and these results already indicate that greater safety and economy are achieved through good programs of proper care of school buses. It would be helpful to school officials responsible for school transportation if case studies of successful preventive maintenance programs were publicized.

In a number of states, driver and mechanic training programs are achieving excellent results. Attention paid to preventive maintenance by trained personnel has increased safety and economy of operation

Courtesy of New York State War Training Bureau

LENGTHENING THE LIFE OF SCHOOL BUSES

By GLENN FEATHERSTON

Senior Specialist on School Transportation, U. S. Office of Education, Washington, D. C.

MANY school people feel that a bus is worn out when it has been used 75,000 to 100,000 miles. While commercial buses and trucks are operated under different conditions, the fact that they are sometimes used for more than 1,000,000 miles is a fairly reliable indication that schools have often failed to get their money's worth in the use of transportation equipment.

Increase Mileage and Cut Costs

In the cost of pupil transportation there are three major factors: (1) the personnel needed to carry on the service; (2) the materials used in the operation of the bus, such as gasoline, oil, and tires; (3) the school bus itself, including depreciation and maintenance. To reduce costs of pupil transportation most remains to be done with the cost of the bus itself. The scale of the community usually determines the level of wages and, aside from good management in selecting and making effective use of the personnel, little can be done here to achieve greater economy. Economies in the purchase of supplies by large quantity buying, bid purchases, and efficient supply management have been widely discussed; and many school systems which operate programs of considerable size have been taking advantage of such procedures for many years.

In cutting bus costs, there are two possibilities. The first is that of purchasing the new bus at the lowest possible cost. This is accomplished largely through fleet purchases on a bid basis of more or less standardized equipment, a procedure now adhered to in several states. The second possibility is to get the greatest number of miles out of the bus without excessive maintenance costs. It is the latter, the practices which some school units have found to be effective in lengthening the life of school buses, which is the subject of this discussion.

Purchase Bus Adequate for Job

The purchase of a school bus which is fitted to the job to be done is the first step in getting maximum mileage from the bus. Too often in the past, schools have purchased light chassis and used them to carry the maximum load for which they are designed in hilly country or in areas where mud or snow prevail through much of the school year. Other schools have bought buses designed for 42 passengers and used them consistently to transport 50 to 60. Still others have purchased chassis and mounted them on longer bodies than those for which they were designed.

Under such circumstances most school administrators have found that the chassis wears out in less time than expected. This has resulted in a high cost per mile for the school bus. Several state supervisors of transportation report that, as a result of these experiences, there is now a definite trend toward the purchase of heavier school bus chassis. Furthermore, it is becoming common practice in the case of buses which have been outgrown in the development of the pupil transportation service to shift them to another run, trade them in, or sell them, and to replace them with buses of the proper size rather than to retain them on jobs for which they are no longer suited.

Eliminate Unnecessary Bus Travel

Using the bus for the minimum number of miles required to accomplish the job to be done is an additional means of lengthening the life of the school bus. This can be accomplished through observance of certain policies. First, the bus route should be so laid out that the greatest number of children can be served in the fewest miles of travel. This will require careful study of a spot map in relation to roads. The objective cannot be achieved if consideration is given to such petty personal preferences as picking up certain pupils last. Second, the duplication of routes to be found in many localities should be eliminated. It is not an unusual thing in some states to find as many as three school buses running down the same road. By enlarging the local unit responsible for the administration of pupil transportation, which of course is a state and not a local problem, and by cooperative arrangements between local units, much of this duplication can be avoided. It is not at all uncommon now to find buses operated by one school unit transporting pupils for a neighboring school unit.

Third, the elimination of short spur trips will not lower the quality of the service below that acceptable for most states. There is little justification for driving a large school bus a quarter or a half mile down a side road to the door of a child unless the child is crippled or unless weather conditions or other factors create an unusual hazard. Similarly, there is little reason to stop a school bus every 100 feet as it drives down a road. It is not unreasonable to ask children to walk short distances to central points along the bus routes except in congested areas. Fourth, employing a bus driver who lives near the end of a bus route will often save many miles. It is not always possible to avoid some waste of bus mileage, but it is usually possible to prevent making the entire run with an empty bus.

Fifth, the bus should be used for more than one trip where such use will not work a hardship on the pupils. In some congested communities it is possible

Courtesy of National Safety Council

The injunction to purchase a school bus which is fitted to the job to be done is not unwarranted, as these pictures show. Failure to observe it is hazardous as well as costly.

The Mercer County Schools (West Virginia) maintain a repair garage with a full-time mechanical force who inspect and repair the fleet of 39 school buses

degree than is justified by the contribution made to the educational program.

Preventive Maintenance Keeps Bills Down

A most important single factor in lengthening the life of school buses is the program of maintenance. Although there are two aspects to this program, preventive maintenance and corrective maintenance, there are many school administrators who in the past have given little attention to the preventive maintenance aspect.

The backbone of preventive maintenance is frequent inspection and servicing of the bus. There should be daily inspection of tire pressures, oil level, and water level by the driver of the bus. There should be weekly inspection of the tires and battery either by the driver or by a mechanic. There should be a monthly or 1,000-mile inspection of brakes, starter, certain engine parts, electrical system, and lubrication by a competent mechanic. If only a few buses are used by a school such inspections can be made over the week-end, but if as many as 18 or 20 are used it will be a money-saving arrangement to have a spare bus to substitute every day for one withdrawn from the regular run and taken into the shop.

Some states and other governmental units have developed excellent inspection and servicing records

to pick up a bus load of children in 15 or 20 minutes by traveling only a few miles. In most of these localities there is no reason why the bus should not be used for second and possibly even third trips. Sixth, in those states where the law permits the use of a school bus for purposes other than to get children to and from school, the board of education should adopt a policy with respect to the purposes for which a school bus might be used. Often it is used indiscriminately without much regard for the educational value of the objectives accomplished. Such use frequently increases the cost of pupil transportation to a greater

The school bus should have a thorough overhauling during the summer. Major jobs such as painting the body and putting new rings in the engine can usually be arranged for the vacation period. One precaution to be observed in the summer months is to make sufficient use of the bus to prevent unnecessary deterioration of certain parts. Periodic inspection and regular service will make it possible to prevent a large

part of the mechanical trouble that might otherwise develop.

Another feature of preventive maintenance is the submission of prompt reports by the bus driver of any troubles located, of any recurring small difficulties, or of indications of developing troubles. A slipping clutch, an engine backfiring, low pressure every day in a tire, an unusual motor or transmission noise, or a loose fan belt are all warnings of trouble to come: a prompt report by the driver and a prompt follow-up by the mechanic will often hold a repair bill to a small fraction of its possible amount.

Closely related to the preventive maintenance program is the hiring of competent drivers, both regular and substitute; no one should be permitted to operate the bus but the drivers employed for that purpose. Many states do not yet have very high standards for school bus drivers, and a large majority of them do not require even a simple road test to check their driving ability. Therefore, it is still largely a local responsibility to employ competent people for this work. School bus driver courses, providing training-in-service in at least seven states, should become much more popular after the war. By preparing the driver to carry his share of the responsibility, they make the preventive maintenance program more effective.

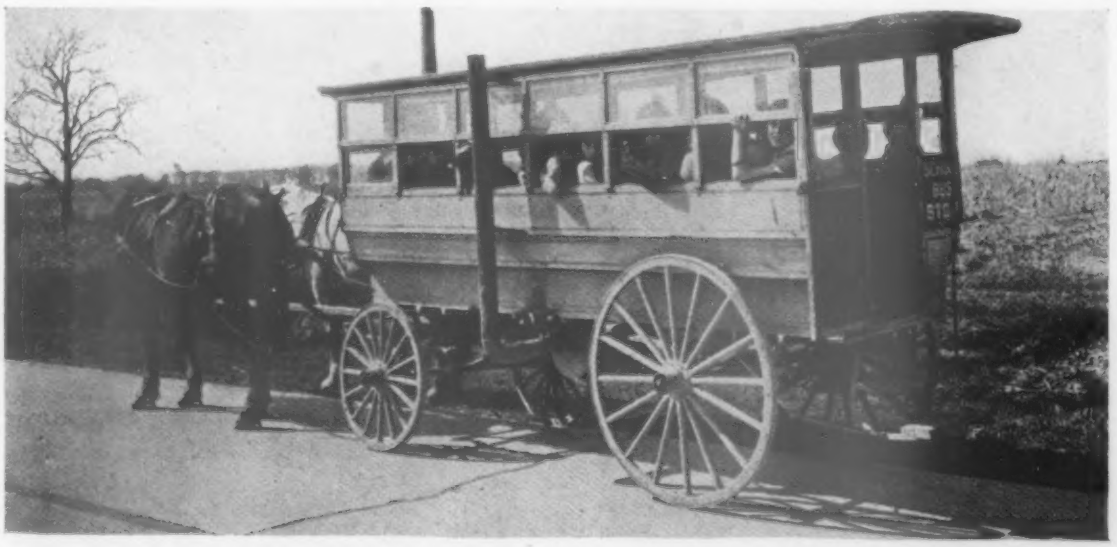
School Garages Achieve Good Results

Between preventive and corrective maintenance, there is no distinct line. One factor contributing materially to both is the school garage manned by mechanics employed by the board of education. The use of private facilities for inspection and repairs and for other servicing does not necessarily preclude an effective maintenance program but it does make it more difficult to achieve. For the same results as from school servicing, a close working relationship with the garage must be maintained. On the other hand, requisites for the school-owned garage are a staff of well-trained personnel and a sufficient volume of work to justify the investment in buildings and equipment. One state supervisor of transportation reports that some counties in his state estimate that, through the operation of school garages begun a few years ago, they have been able to get an average of at least two additional years of life from the buses in their fleets.

Several other advantages are obvious: (1) Schools can junk old buses and keep the usable parts for future use, new methods of repair making it possible to reclaim many parts which until recently were discarded. Usually repairs can be made without delay if a stock of new and used parts is kept on hand. (2) Periodic inspection and servicing are easier to schedule and repairs are attended to more promptly when maintenance of the school buses is the full-time job of the mechanics. (3) The mechanics can be trained to the preventive maintenance point of view, one which not many of them have now—and when school bus mechanics begin to take pride in the extent of the repairs they have not had to make a desirable goal has been achieved.

Cooperation Decreases Road Hazards

The condition of the roads over which the bus operates is one other factor in getting maximum mileage from the school bus, and it is one over which the school authorities usually have little or no direct control. School authorities can fix the route of a school bus only within limits as the condition of the roads does not alter the need for transportation service in a given area. Though today, furthermore, the extent and kind of roads are considered in locating a school building, many of our present structures were located before motor transportation of pupils was a problem. However, cooperation between road and school authorities can do much to improve unsatisfactory conditions. In many places, the location of the school has decided that a certain road was to be hard surfaced. Frequently, in many northern states, the roads traveled by school buses are the first to be cleared of snow. In some local school units, the supervisor of pupil transportation transmits to highway officials summaries of drivers' reports on road conditions, particularly those cases which require repairs. This kind of cooperation, the choice of proper locations for new school plants, and the gradual improvement of our highways will in time eliminate the problem of poor roads to some degree.



"The two-horse power school bus of twenty years ago jogged its way through a safer countryside"

Courtesy of National Safety Council

A MAINTENANCE PROGRAM FOR SCHOOL BUSES

By B. H. BELKNAP

Associate Supervisor, New York State Education Department, Albany, N. Y.

SCHOOL bus maintenance programs are just good business sense in operation at any time, war or no war. Chassis and bodies built on substantial specifications should, when properly used and cared for, deliver a minimum of 200,000 miles of fairly economical service which, in many instances, may span a period of from 10 to 15 years. Replacement parts will be needed, of course, but the cost will be much less per mile on a basis of the overall mileage than for earlier complete replacements.

Drivers and Board Members Know General Aspects

Certain of the general requirements for dependable and economic operation are: (1) fitting each bus to the most satisfactory route; (2) avoidance of overloading even if inner portions of routes have to be retraced; (3) placing thoroughly competent and dependable drivers in charge of all units; (4) housing buses properly when not in use to protect them from effects of weather; (5) placing a thoroughly competent and painstaking maintenance man or mechanic in charge of all regular maintenance work; (6) making adequate and proper facilities available for any usual maintenance or repair work; (7) keeping a careful record of performance, maintenance, and repair of each bus in the fleet.

Much could be written about each of the foregoing general requirements. However, school boards and bus maintenance men are in need of little argument in this connection. Their experience is far more convincing. The drivers are, as a group, fairly well informed on the technique of good bus driver practice. They also report any irregularity in performance directly to the maintenance man. Emergency repairs naturally become their responsibility, but they strive to keep ahead of such happenings through their observations and reports.

But Should Study Manufacturers' Recommendations

For the more formal part of the maintenance programs we suggest consulting the maintenance charts and manuals of the chassis manufacturer. In this connection all chassis manufacturers doing any considerable business in New York State were called upon for assistance in preparing this article. Their materials show an insight into the care and maintenance of their product which the purchaser cannot afford to disregard. Each make of chassis should be cared for through use of the particular manufacturer's charts. Comparisons of charts and manuals show common agreement as to procedure, but much disagreement as to time. It may be pointed out that the qualities, brands, weights, and quantities of lubricants suggested have a wealth of tests and trials to recommend them for the particular uses listed in the manuals.

Check on Delivery and Every 1,000 Miles

Before placing a new bus in service it should be thoroughly checked and lubricated. The 1,000-mile lubrication scheduled by the chassis manufacturer should be observed. The tires should be checked for proper pressure. Battery and radiator should be checked for proper fluid levels. All wheel lugs and

Courtesy of Metropolitan Equipment Corp.

Before placing a new bus in service, it should be thoroughly checked. All wheel lugs and front and rear spring clips over axles should be gone over with a wrench. Check lubrication, tires, battery, and radiator. Test lights, emergency door, emergency brake

MILEAGE MAINTENANCE TABLE*

"A PATTERN OF PROTECTION" FOR YOUR CAR

OPERATION	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	120(
Lubricate chassis, body locks and hinges	O	O	O	O	O	O	O	O	O	O	O	O
Lubricate distributor (oil cup), hand brake linkage, transmission shift linkage, water pump		O		O		O		O		O		O
Change engine oil (in winter) ⊕		O		O		O		O		O		O
Change engine oil (in summer) ⊕			O			O			O			O
Check transmission and rear axle lubricant		O		O		O		O		O		O
Lubricate generator						O						O
Lubricate front wheel bearings—examine brake lining						O						O
Lubricate steering gear						O						O
Lubricate brake and clutch pedals and linkage						O						O
Lubricate starting motor						O						O
Clean and re-oil oil filler cap air cleaner		O		O		O		O		O		O
Check fluid level in brake master cylinder		O		O		O		O		O		O
Add 2 or 3 drops engine oil to wick beneath distributor rotor						O						O
Clean and re-oil carburetor air cleaner						O						O
Rotate tires		O		O		O		O		O		O
Check wheel alignment and balance						O						O
Examine tires for cuts, etc.	O	O	O	O	O	O	O	O	O	O	O	O
Check adjustment of hand and foot brakes						O						O
Clean outside of spark plugs		O		O		O		O		O		
Replace spark plugs												O
Check adjustment of clutch						O						O
Check generator charging rate						O						O
Examine universal joints						O						O
Tune engine (minor)						O						
Tune engine (major)												O
Check fan belt adjustment												O
Check radiator hoses												O
Check lights and headlamp aiming												O

⊕ *Operating conditions less than the most favorable may require more frequent changes. Consult us about your particular needs.*

GENERAL OPERATIONS

Check tire pressure once each week.
Check battery water level once every two weeks.
Check oil level and radiator coolant level every time you stop for gasoline.
Replace oil filter every 8000 miles.
General tightening every 8000 miles.

At start of each summer and winter season the cooling system should be drained and rust resistor or anti-freeze containing a rust inhibitor added. Flush thoroughly.
Every 15,000 miles—Lubricate rear wheel bearings, universal joints, rear axle

*NOTE: Figures indicate mileage *intervals between* maintenance operations, NOT speedometer readings at which operations are to be performed—unless table is applied to a new car at time of delivery. Example: A car first using maintenance table when speedometer registers 7000 miles needs services other than those in 7000 mile column. It should first be Victory Maintenance checked for recent performance of services indicated in previous columns, to be sure that vital operations are not neglected. After proper initial preparation, table can be followed from any speedometer reading, repeating the cycle after each completion of it.

We suggest that you indicate the operations recently performed by checking the proper circles on the chart. Then come in to see us. We'll perform the remaining operations that are necessary for your car's protection and get you started on your program of Victory Maintenance.

Courtesy of Chrysler Corporation

As the timing of procedures varies, each chassis should be cared for according to the instructions of the maker. Mixed fleets can be serviced through a master chart, with checks placed as recommended by the manufacturer

front and rear spring clips over axles should be checked with wrench. Check all lights, signal device on opening of emergency door (if included in your state's specifications), brake pedal pressure, and operation of emergency brake.

The manufacturers are fairly agreed that periodic inspections be based on mileages of 1,000 miles and multiples of 1,000 miles. Beyond this, disagreements arise as to whether a mixed fleet should be serviced through use of individual charts or through a master chart. Charts including columns for each 1,000 miles with all operations listed at the left and checks placed in the proper 1,000-mile column opposite the item of inspection may be made up in quantity, all alike except for the placing of checks opposite such items of inspection as recommended by the manufacturer.

In addition to the foregoing overall inspection schedule, the driver should be provided with brief

forms on which to report on failure or faulty operation of any particular part of the bus. Such reports should be filed without delay.

Radiators, Tires, Batteries

There are other procedures to be followed on a time schedule. These include checking tire pressure each week, checking battery each two weeks, replacing oil filter when oil shows sediment or clouded appearance, or on completion of 10,000 miles of service regardless of discoloration of oil.

Each spring and fall the radiator should be drained and flushed. In each refilling some standard rust resistor should be included and in areas of cold winters an anti-freeze mixture used according to anticipated extremes of temperature. Particular care should be taken to avoid use of anti-freeze mixtures which are injurious to motors and radiators. Some safe anti-freeze materials are denatured alcohol, glycerine, and ethylene glycol. At the time of spring and fall change of oil weight, the crank case should be thoroughly flushed out with standard flushing fluid. Such practice avoids the necessity of removal of base, keeps oil circulation up to normal, and removes possibility of development of crank case leaks.

TABLE 1

RADIATOR ANTI-FREEZE CHART

FREEZING POINT —° F	DENATURED ALCOHOL		ETHYLENE GLYCOL	
	Per Cent by Volume	Specific Gravity	Per Cent by Volume	Specific Gravity*
20	20	.975	17	1.026
10	30	.965	25	1.038
Zero	39	.955	33	1.048
−10	45	.945	39	1.056
−20	50	.935	44	1.063
−30	62	.925	49	1.069
−40	—	—	53	1.073

* Tests at 60° Fahrenheit.

The tire sizes in Table 2 are the ones most commonly used. They cover a range all the way from light station wagons to 60-pupil capacity buses. Information on other capacities may be had from any of the standard tire manufacturers. In contrast to some current recommendations, tires should not be inflated beyond the pressures indicated in the table. Overinflation will cause unduly rapid wear on the face of the tire, while underinflation will cause the edges of the face to wear more rapidly than the center, and sidewalls also will check and crack.

TABLE 2

TIRE PRESSURE CHART

Tire Size	Load* Capacity (Lbs.)	No. of Plies	Inflation Pressure (Lbs.)
6.00/16	915	4	28
6.50/16	1050	4	28
7.00/16	1145	4	26
6.00/20	1400	6	50
6.50/20	1700	6	50
7.00/20	1950	8	55
7.50/20	2250	8	55
8.25/20	2750	10	60
9.00/20	3450	10	65

* Tire and Rim Association ratings.

Tires should be transferred from left to right and front to back each 3,000 miles in order to stretch the life by at least an additional 20 per cent. Care should be taken to have dual tires on the same side fairly closely matched as to wear. Otherwise, uneven wear is bound to take place.

Moderate speed, careful starts and stops, avoidance of scraping curbs in parking and taking curves at slow speed add much to the life of tires. Use of brakes sparingly, except in emergencies, makes a further contribution to tire life. Tires not used for long periods of time should either have the weight removed by blocking up the chassis, or the tires should be removed and stored in a cool, well-ventilated room.

The wheel alignment should be carefully checked at the mileage intervals specified on the maintenance chart of the chassis manufacturer. Any uneven wear on front tires between these intervals also calls for immediate wheel alignment check. It should be borne in mind that there is a specific relationship between toe-in and camber.

During the war emergency it will be necessary to recap tires when the tread has been worn smooth. In normal times the long period of time during which a set of tires are normally used on a school bus makes resort to recaps a rather questionable practice.

Batteries should always be of proper capacity for the particular chassis. For satisfactory battery life, generators should be of sufficient capacity to operate all electrical equipment without drawing from the battery charge. The level of the electrolyte should

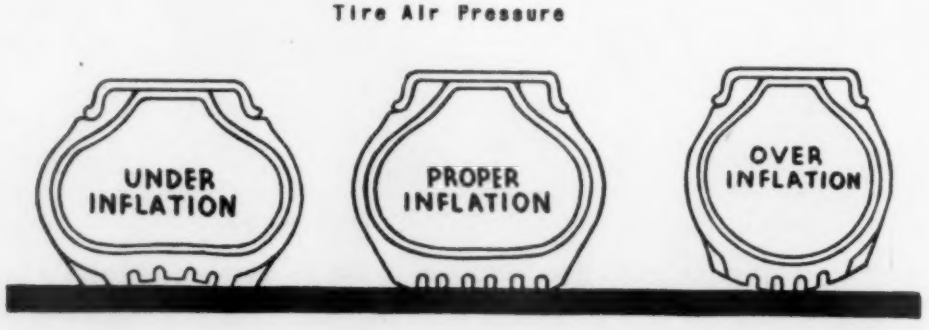


TABLE 3

TEST SCALE FOR BATTERIES

BATTERY CHARGE*	SPECIFIC GRAVITY	
	at 60 F.	at 20 F.
Full	1.275–1.300	1.291–1.316
¾ Charged	1.245–1.270	1.261–1.286
½ Charged	1.215–1.240	1.241–1.256
¼ Charged	1.180–1.210	1.196–1.226
Barely Operative	1.150–1.175	1.166–1.191
Discharged	1.120–1.145	1.136–1.161

* Batteries less than 1.200 specific gravity are liable to freeze in cold winter weather.

be kept about three-eighths of an inch above the plates. Distilled water should be used. Tests at two weeks' intervals usually make possible avoidance of battery failures or at least give ample warning. Rate of charging by generator needs careful attention.

Battery terminals should be kept free from corrosion. A light application of ordinary cup grease to the positive and negative posts prior to making the connections is common practice. Additional sulphuric acid will seldom be necessary as the lead sulphate formed by action of the acid on the lead plates is reconverted to sulphuric acid through the electric charging process.

Wartime Precautions

Certain wartime practices may be out of line with peacetime procedure, but need special emphasis at this time. The 3,000-mile ignition checkup should be most thorough. Plugs should be removed, cleaned, and spark gap adjusted. For proper gap consult the manual of the chassis manufacturer: do not accept the old general practice of .025 inch as final; it may be .032 inch or even .040 inch in certain motors. Distributor points need cleaning and adjusting. Maximum distributor shaft clearance may not be more than .005 inch without trouble. The shaft and bearing may need replacing.

The carburetor should be cleaned, idling jet properly set, sediment bowl emptied and cleaned, and throttle set so as to cause a free idling speed of motor without racing. Fuel and vacuum pump diaphragms need examination at 12,000 and replacement at first evidence of undue oil consumption.

Spark plugs should not be discarded at 10,000 or 12,000 miles, but should be used until tests under pressure show them defective. Normally, replacement of plugs regardless of condition is considered good practice at not more than 12,000 miles of service.

Front wheels should be pulled, bearings removed, washed, examined, and repacked each 3,000 miles. Worn bearings should be discarded. At the time of pulling wheels the brake bands should also be examined, and in case rivets show even light marks on brake drums it is time to reline brakes.

Alcohol, with its low boiling point, requires frequent checking in order to insure freedom from frozen radiators and damage caused by such freezing. The ethylene glycol products are not so affected and as a result are more desirable for winterproofing the cooling systems of school buses. All that is necessary when ethylene glycol products are used is to add water to keep the radiator at the proper level. Such practice, however, is based on the assumption that hose connections and head gasket are free from leaks.

Tire care justifies special attention. This is particularly true during war years in order to eliminate over inflation as well as underinflation. Examination for cuts, imbedded pebbles and small nails, tacks, or other causes of trouble is particularly necessary on a 1,000-mile basis.

As often as each third lubrication time all wheel lugs should be checked for tightness, and at time of greasing rear wheel bearings care should be taken to avoid too much lubricant. Excess lubricant is bound eventually to work into the brakes. Any evidence of escaping lubricant should be stopped by removing the wheel, wiping away any accumulated grease on exposed parts and replacing grease retainers with new ones.

Electrical parts must always be lubricated sparingly. Too much lubricant or lubricant applied too often is worse than not enough. Above all, keep all outer surfaces of motor and accessories free from dirt, oil, or grease deposits.

Watch Out for Warnings

Finally, drivers should keep a constant eye on the various gauges on the instrument panel. Any deviation from perfect performance soon shows up "right in the driver's face." He may well listen and even feel for warning signals, all of which should be communicated to the maintenance personnel. On starting out on each trip he should form the habit of a "once-over" checkup. This covers tires, brakes, gas, oil, radiator, horn, clutch, clean windshield, adjusted rear view mirror, and windshield wiper.

Preventive Maintenance Pays

Good equipment, placed in competent hands and systematically serviced and repaired, renders the most economical transportation service. In a word, it pays to pay attention to school bus needs.

In New York State, the older buses continue to render service by strict adherence to the maintenance procedures outlined

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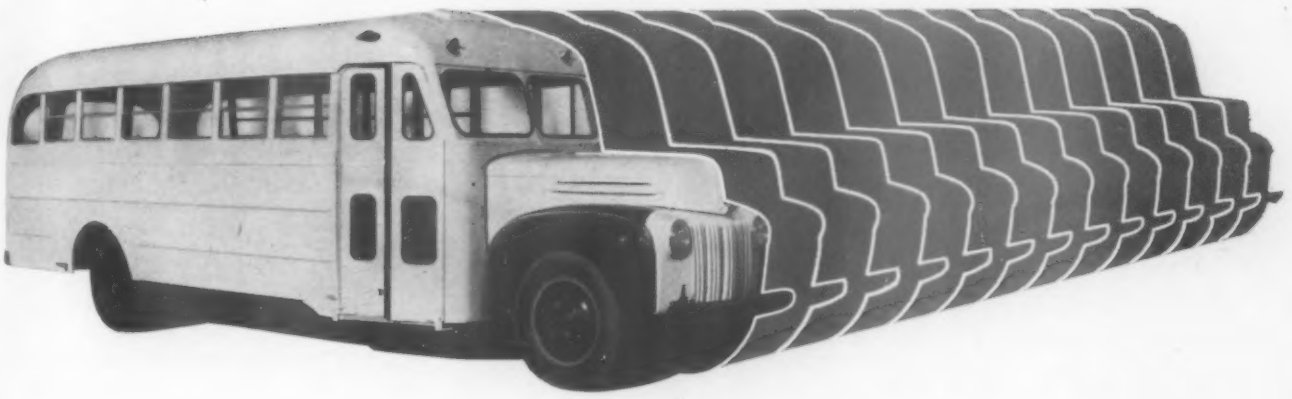

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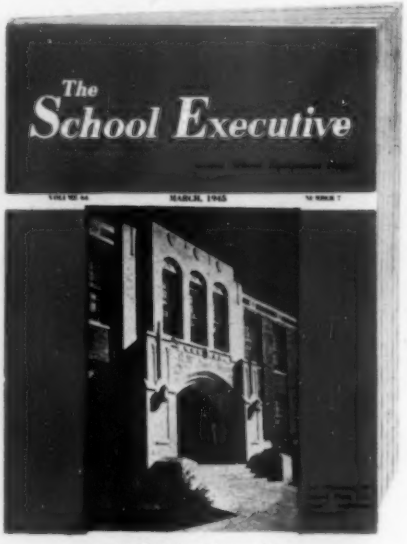

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In the short time since this new feature first appeared in The SCHOOL EXECUTIVE in January 1945, it has won wide approval. School administrators are subscribing to reprints of *Our Schools* in quantity lots of from ten to one hundred copies each for monthly distribution to their school board members and others. . . . It is apparent that *Our Schools* is filling a hitherto unmet need in sound public relations between schools and the communities they serve.

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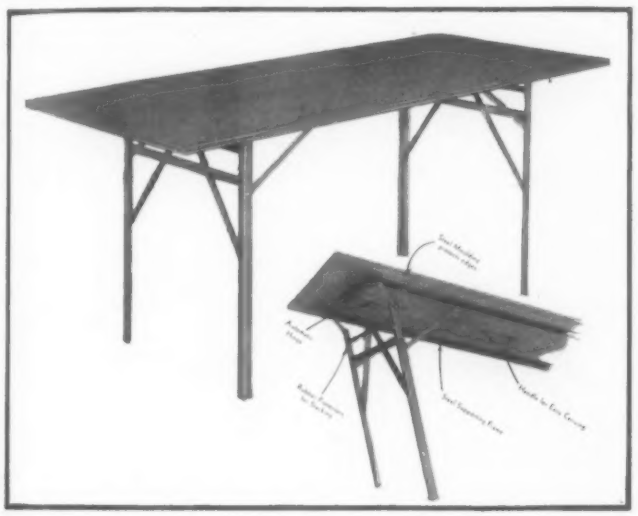
THE BREWER-TITCHENER CORPORATION

118 Port Watson St.
Cortland, New York

Hostess FOLDING PRODUCTS



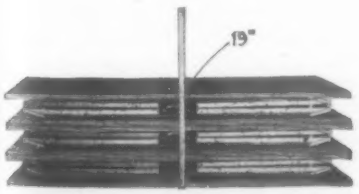
FOLDING BANQUET TABLES

The construction feature of an all-steel frame (Note illustration) gives exceptional lightness with superior strength and rigidity. Frame and legs are of 1 x 1 x 7/64" high carbon angle steel. The legs are finished in buff, and the frame black enamel.

One man can quickly set them up or knock them down by a simple swing of the legs. The legs operate in units of two. Automatic locking device with positive catch requires no manipulation.

The tops are regularly furnished with beautifully grained ply panel, finished with two coats of heat and stain resisting hot-spray lacquer. All tops are oil dipped to resist warpage, and all edges are protected with an attractive steel moulding around the entire top.

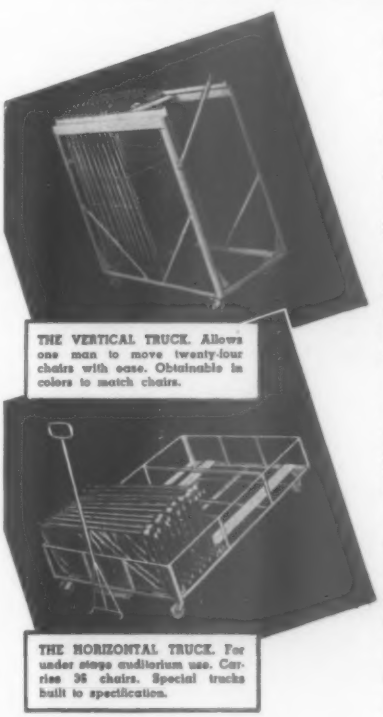
Obtainable in various sizes including the rounds; also with tempered masonite and linoleum tops.



Stacks 6 to 19½ Inches

ALL METAL FOLDING CHAIRS

DELUXE FOLDING CHAIRS


THE VERTICAL TRUCK. Allows one man to move twenty-four chairs with ease. Obtainable in colors to match chairs.
THE HORIZONTAL TRUCK. For under stage auditorium use. Carries 36 chairs. Special trucks built to specification.

Hostess DeLuxe chairs depart entirely from old time construction principles. Here is a full back and full seat all-steel, all-riveted folding chair, upholstered both back and seat. When folded, the upholstering is between two protecting metal parts that form back and seat, thus eliminating danger of damage to upholstery during storage. Hostess DeLuxe chairs are obtainable in many color combinations and all metal parts are finished in beautiful metallic colors. All chairs are equipped with large pure rubber feet.

11 SONNEBORN *aids* TO BETTER SCHOOL MAINTENANCE

✓ LIGNOPHOL for Wood Floors, Trim

LIGNOPHOL is no ordinary surface finish, but a beautifying and preservative treatment that penetrates into the wood, depositing toughening resins and life-imparting oils which resist moisture, molds, fungi and wood-destroying organisms. Recommended for the preservation of floors and for beautifying trim and paneling. LIGNOPHOL assures substantial economies in time and labor, because only a single application is required to obtain its full benefits.

✓ LAPIDOLITH LIQUID for Concrete Floors

A patented colorless liquid which hardens, dustproofs and protects concrete floors for many years, by chemical action. The application of LAPIDOLITH LIQUID will not interfere with daily schedules since floors can be kept in use during and directly after application, if necessary. LAPIDOLITH LIQUID also hardens and wearproofs terrazzo floors.

✓ CEMCOAT Filler and Dustproofer

A tough, resilient compound of treated gums, varnishes and oils. Penetrates and dries with a hard but flexible film, providing a smooth, dustless and highly decorative finish for cement or concrete floors. Primarily for concrete, but can also be used on wood floors. Available in 8 colors, white, and transparent.

✓ FLOORLIFE CLEANER

A unique type of wood floor cleaner which renews the finish as it cleans. It is neutral and does not raise the grain, discolor or warp the wood as do alkaline or other harsh chemical solutions.

✓ SONOSHEEN for Waxing Floors

A non-rubbing liquid emulsion wax adapted for maintaining floors of rubber, linoleum, tile, asphalt, terrazzo, composition, also varnished and painted floors.

✓ CEMCOAT for Walls and Ceilings

CEMCOAT is a carefully processed oil-base interior paint formulated from the most modern tested pigments and a specially treated vehicle. CEMCOAT fits perfectly into any balanced color program. It enjoys wide acceptance among school maintenance men and superintendents wherever better light reflection is desired and the ability to withstand frequent washings is necessary for economical maintenance. CEMCOAT is available in enamel, semi-gloss, eggshell and flat—in white and a variety of attractive and serviceable shades. It is easy to apply and gives long-lasting service.

✓ STORMTIGHT for Roofs

A protective compound for surfacing, patching and repairing roofs. Nationally known for outstanding quality. In Liquid and Plastic forms. For use on all types of roofs, including felt and composition, tin, corrugated iron, galvanized and other metal, tar and gravel or slag, concrete, shingle and canvas.

Anyone who can handle a paint brush can apply STORMTIGHT quickly and successfully. It is applied cold. Shipped ready for use—no thinning or heating required.

✓ CAULKING COMPOUNDS

SONNEBORN has been identified with the manufacture of airproof, waterproof and elastic caulking compounds for many years. SONNEBORN Caulking Compounds are used extensively on federal projects and meet U. S. Bureau of Standards tests. They function efficiently under a wide range of climatic conditions. Shipped in gun or knife grade, or in cartridges.

✓ HYDROCIDE Colorless for Exterior Masonry

Protects brick, concrete, masonry and stucco walls against the cumulative effects of rain, snow and sleet, without changing the texture and beauty of the surface to which it is applied. HYDROCIDE COLORLESS is free from wax and oil; therefore, it is unaffected by extreme heat or cold. Hundreds of applications to masonry of all types demonstrate its efficiency in all kinds of weather.

✓ S. R. P. for Protecting Metal Surfaces

For any iron, steel, or galvanized iron surfaces, etc. Suitable alike for interior and exterior use. Outstanding for its remarkable rust-inhibitive properties. Often eliminates necessity of scraping surfaces to bare metal before repainting—simply remove loose or scaling rust. S. R. P. Coating is unusually resistant to corrosive agents other than air or moisture; even acids, alkalies and salt water find an impenetrable barrier between the S. R. P. Coating and the metal which it protects.

✓ PAINTS, ENAMELS, VARNISHES

There is a SONNEBORN paint, varnish or enamel especially designed for protecting and decorating every inside and outside building surface. SONNEBORN exterior paints have been noted for decades for their appearance and weather-resistant qualities. Inside, SONNEBORN specialty paints find a wide range of applications on walls, ceilings, floors and equipment of all types.

Free TO SCHOOL EXECUTIVES

Write Dept. U45 for Sonneborn's 16-page building maintenance manual—and call on Sonneborn for practical help in solving problems of school protection against moisture, weather or wear.

BUILDING PRODUCTS DIVISION

L. SONNEBORN SONS, Inc.

88 Lexington Avenue, New York 16, N. Y.

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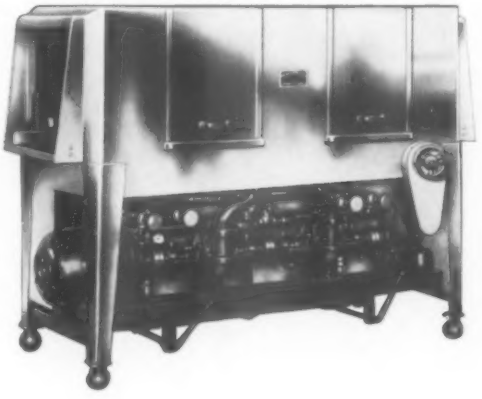

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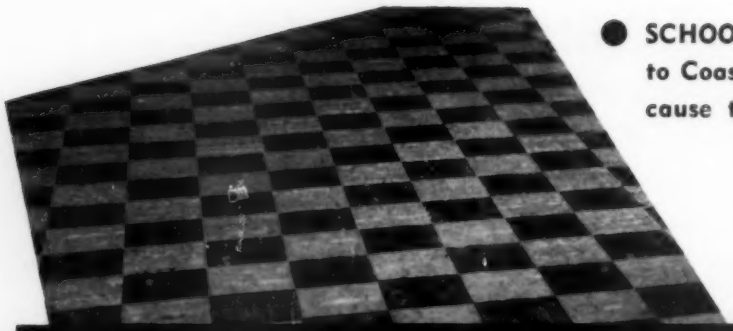

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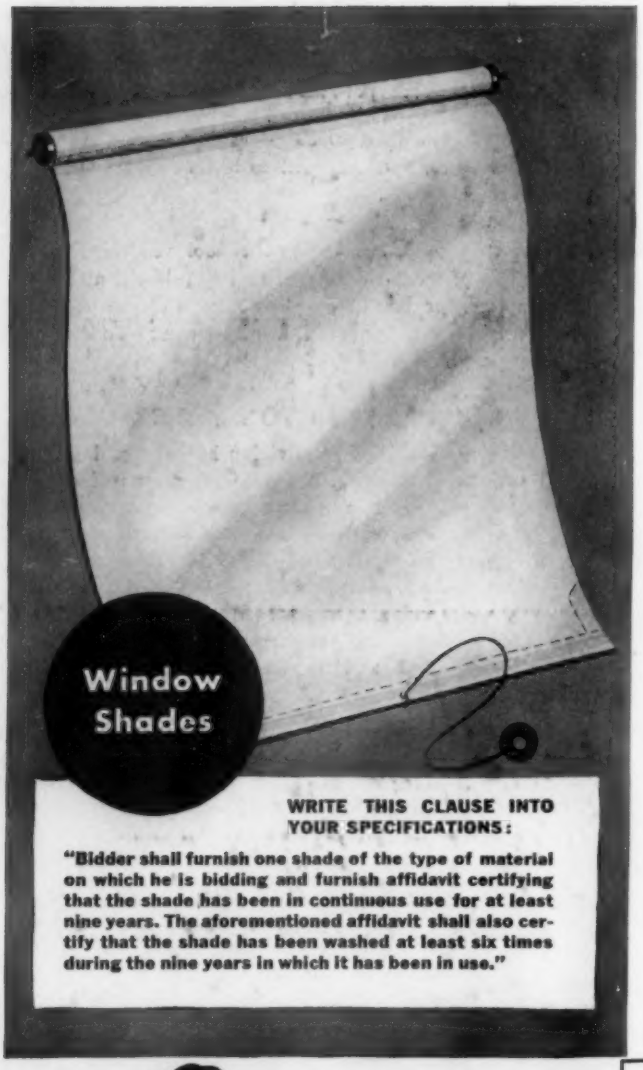
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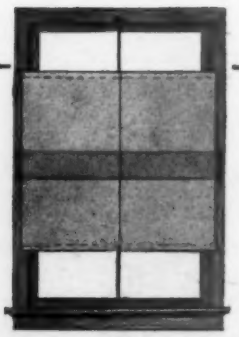

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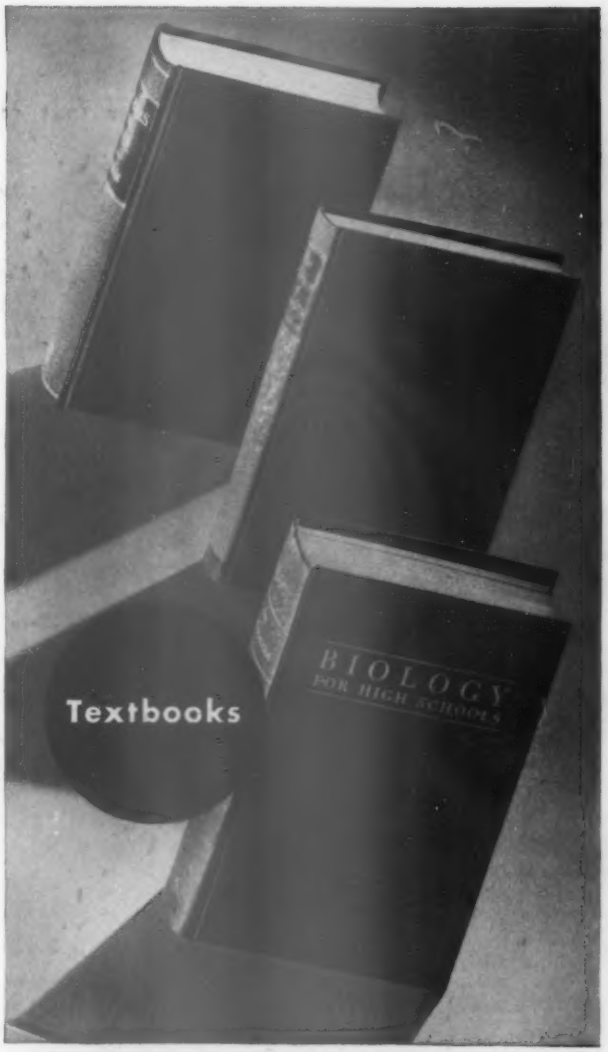

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